M/35/002

FINAL REPORT
SOUTH JORDAN EVAPORATION PONDS
SITE NO. 3B

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FINAL REPORT
SOUTH JORDAN EVAPORATION PONDS
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Notice of Completion

South Jordan Evaporation Ponds
Site No. 3B

Pursuant to Part VI, Paragraph 38 of the Administrative Order on Consent for the South Jordan Evaporation Ponds, Site No. 3B, Kennecott Utah Copper Corporation submits the accompanying Final Report for the Site and certifies that all activities required under this Order have been performed and completed.

Under penalty of law, I certify that, to the best of my knowledge, after appropriate inquiries of all relevant persons involved in the preparation of the report, the information submitted is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Kennecott Utah Copper Corporation

By William R. Williams
William R. Williams

Its Director, Health, Safety and Environmental Quality

Kennecott Utah Copper Corporation
PLANT PROJECTS GROUP
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Kennecott

August 12, 1996

Mr. Sam Vance 8HWM-SR
Regional Project Manager
USEPA Region VIII
999 18th Street, Suite 500
Denver, Colorado 80202-2405

RE: Final POLREP and Final Report
South Jordan Evaporation Ponds Site 3B

Dear Mr. Vance:

Transmitted under cover of this letter are four copies of the Final Report for the work related to the South Jordan Evaporation Ponds in Salt Lake County, Utah. The Final Report is submitted in compliance with requirements of the Administrative Order on Consent ("Order"), CERCLA-VIII-18. A final "POLREP" (pollution report) is also enclosed, as requested.

In compliance with Article VI paragraph 38 of the Order, a signed Notice of Completion is enclosed in Volume 1. The original signature document is in the copy of Volume 1 designated as "ORIGINAL" on the cover.

Kennecott requests that certification of completion for this Final Report be sent at your earliest convenience.

Please call if you wish to discuss the transmitted reports, or any other aspect of the work related to the Order for the South Jordan Evaporation Ponds.

Sincerely,

William R. Williams

William R. Williams
Director, Health, Safety and Environmental Quality

encl: 4 copies, Final Report (4 vols. each)
1 copy, POLREP

cc: Kathleen E. Johnson, UDEQ

FINAL REPORT

SOUTH JORDAN EVAPORATION PONDS
SITE NO. 3B

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FINAL REPORT

SOUTH JORDAN EVAPORATION PONDS SITE NO. 3B

1.0 INTRODUCTION

1.1 Final Report Compliance with Order

The following Final Report is submitted in compliance with, and in satisfaction of, the requirements of Section VI of the Administrative Order on Consent ("Order"), and, in particular, paragraph 38, "Final Report".

1.2 Site Description

The South Jordan Evaporation Ponds site is located seven miles east of the Bingham Canyon Mine, one mile south of Bingham Creek, five miles west of the Jordan River, and one mile west of the City of South Jordan (see attached Drawing No. 451-T-3504). The site consisted of 25 distinct ponds separated by earthen embankments and seven adjacent ponds. The ponds covered approximately 536.5 acres, and the adjacent areas covered approximately 619.5 acres (ref. Dwg. 451-T-3505). The site is within T3S, R2W, and Sections 7, 8, 17 and 18, R1W, Salt Lake Base and Meridian.

The South Jordan Evaporation Ponds were used to store and evaporate Bingham Creek waters, including storm water, mine tailwater and the sediments transported by those waters from Bingham Creek and from ARCO's Tailings Ponds. The pond sediments include water-deposited sand, silt, tailings, lime-treated and untreated sludge, and other soil materials. Sediments in the ponds formed a crust that minimized dust blowing off the site.

The ponds were utilized from 1936 until 1965, and again intermittently, for stormwater only, during the period from 1973-1986. Following construction of the Large Bingham Reservoir in 1965, the ponds were used on an emergency basis only to store and evaporate excess runoff from the Bingham Canyon watershed, although they continued to receive precipitation and local runoff from the Bingham Creek drainage below the reservoir. Water from drainages above the Large Bingham Reservoir was discharged to the site during the extremely wet periods of 1973-74, 1975-76 and 1983-84. Additional ponds were constructed in 1983 and 1984. These storm water ponds were utilized until 1986. The Evaporation Ponds were not used for process or storm water diversion after 1986.

1.3 Project Summary

Kennecott performed the excavation, transportation, consolidation and placement of the South Jordan Evaporation Ponds sediment, and reported weekly to the EPA and the State of Utah DEQ on progress made. Prior to finalization of the Order, an Investigation Work Plan was submitted to EPA, guiding the characterization of the site soils. A Consolidation Work Plan, submitted on initiation of the Order, described procedures for excavation, transportation, placement, consolidation and capping of pond sediments (ref. work plans, bound in Vol. 1 of this Final Report). Removal and placement of waste rock and materials with elevated levels of the indicator metal (lead) was also described in the Work Plan. The Work Plan was reviewed and approved by EPA and the State of Utah prior to commencement of work. All work activities on the site, including investigation, consolidation and reclamation, as well as QA/QC, were conducted in accordance with the respective Work Plans.

The site investigation/characterization was performed in the fall and winter of 1993-94, as outlined in the Investigation Work Plan. The site characterization, transmitted previously to EPA, is also included in Volumes 2 and 3 of this Final Report. Appendices of both work plans presented site-specific soil sampling and analysis / QA project plans, air monitoring plans and health & safety plans.

The pond sediments were excavated, transported on-site, placed and blended with existing berm and granular borrow materials from within the site boundaries to optimize compaction, and to provide a low-permeability cover over existing pond sediments in the consolidation area. On completion of consolidation activities, a 36" clean soil cover was placed over the entire consolidation area, with the top 6" consisting of topsoil to support revegetation.

The waste rock incorporated into pond dikes was removed to locations within Kennecott's Bingham Canyon Mine waste rock disposal area. Soils with elevated levels of lead from Pond AO and from the ditch leading to the Evaporation Ponds were removed and placed into Kennecott's Bluewater I Repository, under the separate removal action of the Bingham Flats segment of the Phase II Bingham Creek Channel Removal (Site T4). The Final Report for that project is being submitted to EPA under separate cover. Removal, consolidation and reclamation activities were expedited to the maximum extent, to minimize disturbance to nearby residential areas. Three shifts worked 24 hours per day for most of the project, compressing the schedule to as brief a period as possible.

After completion of excavation, confirmation sampling was performed to ensure that target cleanup levels were achieved prior to placement of clean soil cover. The cleaned ponds and adjacent areas were covered with subsoil and 12" of topsoil from sources verified to contain insignificant levels of contaminants. The cleaned ponds and adjacent areas were recontoured to blend in with surrounding topography. This reclamation of soils will enable conventional farming activities to resume in all cleaned areas excluding the consolidation area.

Kennecott installed a new fence and improved existing fences around the perimeter of the property, to limit access to the property.

2.0 EXCAVATION, TRANSPORTATION AND PLACEMENT OF SOILS

2.1 Excavation

Excavation of pond sediments for placement in the consolidation area was accomplished using Cat 631 E, 637E and 651E scrapers. The scrapers were loaded using Cat D10N and D11N push cats, while the 637E scrapers were used in tandem, utilizing self-loading capabilities. Excavation of pond sediments began June 6, 1994, and was completed October 15, 1994, after post-removal confirmation sampling determined that removal areas had met or exceeded cleanup action objectives.

Excavation of mine waste rock from the dikes was accomplished used a rubber-tired front end loader and highway haulage dump trucks. Excavation areas were premoistened to minimize airborne dust emissions during loading, transport and placement of waste rock. Operators and drivers were required to keep windows rolled up during loading and unloading operations to minimize the possibility of exposure to airborne emissions. Removal of waste rock commenced on June 7, 1994, and was completed on June 28, 1994.

2.2. Transportation

Transportation of pond sediments removed from selected ponds and adjacent areas to the consolidation area was accomplished using haul routes between the loading areas and the placement site constructed for the purpose. Haul routes were continuously maintained with a Cat 16G motor grader for safe access. Water application on all haul routes was maintained continuously with water wagons of up to 12,000 gallon capacity to minimize exposure to airborne emissions. The staging area was also treated with a commercial road treatment compound to minimize dust.

Mine waste rock transport was completed as described in the Work Plan (Section 2.4.3 "Haul Route"). Haul routes were monitored and an Emergency Spill Contingency Plan was instituted prior to start of work. No spills occurred, however, therefore the Emergency Plan was not activated.

2.3 Procedures and Controls

Placement and consolidation of pond sediments into the consolidation area was completed before the clean soil cover was placed. Pond sediments were mixed with berm and granular materials and disced together with a Cat Challenger 65 and 10" disc. The soil materials were moisture-conditioned and wheel-rolled to ensure that compaction specifications were met. A Cat 825 sheepsfoot roller was employed to assist in compaction efforts. All materials were compacted to 90% compaction (Modified Proctor) before additional material was placed.

2.4 Decontamination

Equipment used in consolidation activities was decontaminated with portable decontamination equipment prior to removal from the site. All material collected during these decontamination activities was placed in the consolidation area. Highway haul trucks were visually inspected prior to departure from the site and entry onto the highway. Soil deposits and potential spillage materials were manually removed from vehicles and placed either into the consolidation area or into the waste rock disposal area at the waste dumps, as appropriate to the nature of the materials. The haul routes and the staging area were decontaminated prior to completion of work activities, and these soil materials were also placed into the consolidation area.

3.0 PERSONAL PROTECTION AND AIR MONITORING

3.1 Personal Protection

The Kennecott health & safety program emphasizes proper training, contractor planning and recognition of health and safety hazards, frequent on-site informational meetings and Kennecott monitoring of contractor practices and work conditions. The application of the Kennecott health & safety program to the South Jordan Evaporation Ponds site is more fully presented in the Final Health & Safety Report in Volume 1 of this Final Report submittal.

Personal protection and personnel-related air monitoring activities were implemented according to the site-specific health & safety plans incorporated into the respective work plans. Comparative monitoring of blood lead and urine arsenic levels was instituted for the duration of the project. All employees working in excavation, consolidation and transportation activities were required to have blood lead and urine arsenic tests prior to beginning work on the site, and again after completion of the work. The results of this monitoring are summarized in the Final Health & Safety Report.

Level D personal protection equipment, plus cotton coveralls, were required during excavation, transportation and placement of materials. Half-face respirators were available for use in the event of occurrences of elevated levels of airborne particulates, but they were not needed during the project. All employees and supervisors working in excavation and placement of materials were required to undergo 40 hours of hazardous substance awareness training. The required personal protection equipment and training effectively protected the employees from potential injuries and minimized the amount of dust carried off site by workers.

Personal decontamination facilities were set up in the staging area, away from the site. These facilities consisted of two 60-foot trailers. The "dirty" trailer contained clothes hooks, lockers and washing facilities. The "clean" trailer contained tables and chairs, facilitating use as a break room and lunch room. Toilet facilities were set up nearby, outside the trailers.

All employees were required to remove their coveralls and to wash in facilities in the "dirty" trailer prior to entering the "clean" trailer for breaks, lunch or the end of a shift. These procedures gave the employees areas in which to store their clothing, wash dust from hands and face, and take lunch breaks in an uncontaminated area. Any soil that was tracked into the trailers was cleaned up daily and placed in the consolidation area. Water from the wash facilities was collected and spread throughout the consolidation area as required for soil conditioning or dust suppression.

Safety was constantly emphasized and monitored as the first priority of project activities. Through maintenance of proper training, planning and hazards identification and awareness, a program of accident avoidance was conducted successfully for the duration of the project. The Final Health & Safety Report, included elsewhere in Volume 1 of this Final Report, presents further discussion of the program.

3.2. Air Monitoring

Air monitoring at the loading and consolidation areas was conducted by Kennecott to assess levels of airborne lead, arsenic, silica and total dust. Personal air monitoring was conducted, in addition to ambient air monitoring. Dry, windy meteorological conditions prevailed during a portion of the project's consolidation phase, which coincided with a period of intensive soil preparation and planting activities on adjacent farm properties, construction of a housing subdivision, and conventional operations at the landfill to the west and at the clay pit serving the brick plant to the north.

Production of dust became unavoidable in the intervals of extreme heat, low humidity and wind, which averaged in excess of 40 miles per hour at times. Other contributing factors, such as nearby forest fires and grass/brush fires, heightened already difficult air quality management conditions. A storage pond for dust-suppression water was built, and a temporary pipeline from an upgradient production well was installed to fill the pond. Pumps in the pond fed water into tanker trucks equipped with spray equipment. Despite application of approximately one million gallons of water per day to the project area, dust from the work area and from bare farm ground as far away as the town of Herriman exacerbated ambient particulate levels intermittently in the project area for a period of approximately one month. Data from air monitoring stations documented the "exceptional events" imposed by sustained high wind velocities. Other than the flagged, designated exceptional events, fine particulates remained within acceptable ranges. No significant levels of metals or other airborne contaminants were detected, however, even during periods of high TSP. The results of all Kennecott air monitoring activities are summarized in the Final Air Monitoring Report, included in Volume 1 of this Final Report.

4.0 RECLAMATION

4.1 The South Jordan Evaporation Ponds area was regraded after confirmation sampling demonstrated that removal of contaminated soils was complete. A clean soil cover was placed over disturbed areas. The consolidation area received 36 inches of clean soil cover, while adjacent areas and cleaned ponds received a 12 inch (minimum) soil cover. Topsoil was salvaged, where acceptable, during all construction activities and placed on the soil cover in all disturbed areas. The topsoil was scarified to depths of 6 to 16 inches and disced to allow seeding.

Initial reseeding of the consolidated area with natural grasses was completed in spring 1995. The condition of vegetation on all reseeded areas was monitored through 1995, and remedial revegetation was performed in December 1995 and, finally, in spring 1996.

The consolidated area was seeded using drill/pit seeding techniques. Seed was applied at a rate of 24 pounds of pure live seed (PLS) per acre. The seeded area was fertilized with a commercial, granular fertilizer that provided 40 pounds of available nitrogen per acre with a 28N:13P:13K blend.

The following seed mixture was used to reseed the consolidation area:

Species	Lbs PLS/Acre
Western Wheatgrass	6.0
Thickspike Wheatgrass	6.0
Slender Wheatgrass	6.0
Streambank Wheatgrass	6.0
TOTAL	24.0

The consolidation area was contoured to provide drainage and to minimize erosion. The cleaned areas were recontoured with borrow material to blend in with surrounding topography. Conventional farming activities are thus allowed to resume in all cleaned removal areas, exluding the consolidation area, where no farming is to be permitted.

The borrow area was also reshaped to control storm water runoff and to minimize storm water transport of soils. Additional topsoil was placed where considered necessary. The borrow area is being returned to farming use.

Kennecott installed new fences and improved existing fences around the perimeter of the property boundaries, to limit access to the area, thereby protecting reestablishment of vegetation.

5.0 QUALITY ASSURANCE/QUALITY CONTROL

QA/QC functions during excavation and consolidation of pond sediments, and during removal of waste rock from former pond dikes, were provided as follows:

• Geotechnical monitoring	AGRA E&E
• Soils Sampling	North American Exploration
• Air Monitoring	Envirocon, Inc.
• Survey Control	KUC Plant Projects Group
• Project Management	KUC Plant Projects Group
• Project Oversight	USEPA Reg. VIII S.J. Vance, OSC

Geotechnical QA/QC observation was continuous during excavation, consolidation, compaction of pond sediments, placement of clean soil cover and topsoil placement. AGRA E&E verified that consolidation and compaction of pond sediments in the consolidation area were within the specified acceptable range for soils placement by performing lab and field tests before, during and after placement of consolidated materials. A compaction average of 93.7 percent dry density was attained (Modified Proctor) from 718 moisture/density tests taken on the blended pond sediments throughout the consolidation area.

The geotechnical QA/QC service also made field observations to ensure that placement, consolidation conditions and lift thicknesses were within specified requirements. Field and laboratory permeability testing was also performed by AGRA E&E throughout the consolidation activities. Results of 43 field tests by sealed single-ring infiltrometer, at various depths and locations throughout the consolidation, area show an average permeability value of 6.2×10^{-5} cm/sec. Laboratory triaxial/falling head tests show an average permeability value of 1.4×10^{-5} cm/sec on 67 samples taken at various depths and locations throughout the consolidation area. Results of field and laboratory testing performed by AGRA E&E throughout consolidation activities are included in Volume 4 of this Final Report.

Post-removal samples were taken by North American Exploration at the conclusion of excavation of each pond and of each of the adjacent areas outside the consolidation area footprint. Post-removal samples were delivered to Ford Analytical Laboratories in Salt Lake City, Utah. These samples were analyzed for lead, arsenic, pH and sulfate concentrations, with lead designated as the primary constituent of concern. Samples taken were 5-point composite samples collected from sample cells four hundred feet square in configuration. Sample subsites were located in the field using surveyed points as reference and were arranged in the field to optimally cover the actual removal area (ref. Post-Removal Sampling and Analysis Report in Vol. 4).

QA/QC of air monitoring was conducted concurrent with ambient and personal air monitoring activities. Air monitoring started prior to the pond sediment and waste rock relocation action, and was continued through the completion of consolidation/relocation operations. Daily samples were collected with stationary and personal monitors to assess the air quality in and around the work areas. Personal air monitoring instruments were calibrated at the beginning and end of each sampling day. All samples were logged and chain-of-custody procedures were followed to ensure the integrity of the sampling procedures. Internal QA/QC audits show that overall system integrity and conformance with the approved sampling plan objectives were achieved throughout the relocation and consolidation operations. (Ref. Final Air Monitoring Report included elsewhere in Vol. 1 of this Final Report.)

Survey and project management functions were provided by Kennecott Utah Copper Plant Projects Group for the entire duration of the project. The consolidation area, the waste rock disposal area, borrow areas and haul routes were surveyed for quantity measurement, verification of soil cover depths, and conformance of recontouring with design topography. Project management functions included engineering design, reclamation and revegetation design, work plan production and compliance assurance, contracting and construction supervision and report development throughout construction activities. All project management functions were carried out by KUC Plant Projects Group personnel.

6.0 CONCLUSION

The South Jordan Evaporation Ponds consolidation and removal project was conducted expeditiously and successfully, followed by an effective program of reiterative revegetation of disturbed areas. Work was sustained at maximum intensity, 24-hours per day, in a concerted effort to minimize the duration of disturbance to the project's neighbors. Mine waste rock and small quantities of contaminated soils were removed to a controlled location within the Kennecott waste rock dumps. Contaminated soils (primarily sulfates in the form of gypsum) from 536.5 acres of abandoned ponds and portions of 619.5 acres of adjacent, affected areas were consolidated onto a "footprint" of approximately 250 acres, then covered with 3 feet of subsoil and topsoil. The areas from which these soils were removed was also covered with topsoil, and the entire project area was reseeded with reclamation seed mix or, in the case of areas to be returned to farming use, prepared for planting of wheat or other dry-farming crop.

As evidenced by the progress photographs attached to this report, a large, formerly disturbed area has been restored to a sustainable topography and vegetational cover. Because of the extreme drought conditions that prevailed late in 1994, multiple reseeding applications were required. Relatively moist conditions in 1995 were favorable to seed germination, however, successfully establishing the desired plant community. Quality control/quality assurance procedures were applied rigorously, ensuring that the Investigation Work Plan and the Consolidation Work Plan were followed throughout.

7.0 PHOTOGRAPHS

(Attached on following pages)

INVESTIGATION WORK PLAN

DRAFT

SOUTH JORDAN EVAPORATION PONDS

INVESTIGATIVE WORK PLAN

KENNECOTT UTAH COPPER

BINGHAM CANYON, UTAH

SITE No.

Prepared and Submitted by:

Kennecott Plants Projects Group
Bingham Canyon, Utah

November 15, 1993

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1.0 INTRODUCTION

Detailed Site characterization activities for the South Jordan Evaporation Pond Site on Kennecott property and/or selected, adjacent properties involve a broad set of soil investigations, water, and air sampling for these locations. This Work Plan describes the sampling program to be implemented at the South Jordan Evaporation Ponds (the Site) to further assess soil conditions for design and evaluation of potential remedial actions.

1.1 BACKGROUND

The South Jordan Evaporation Ponds (the Ponds) are located seven miles east of the Bingham Canyon Mine, one mile south of Bingham Creek, five miles west of the Jordan River, and one mile west of the City of South Jordan (Figure 1). The Ponds were used to store and evaporate Bingham Creek waters, including mine tailwaters, storm waters and eroded sediments from Bingham Creek and ARCO's Tailings Ponds. The sediments currently in the Ponds will be referred to in this report as pond waste.

The Ponds were utilized as outlined above from 1936 until 1965. Following construction of the Large Bingham Reservoir in 1965, the Ponds were used on an emergency basis only to store and evaporate excess runoff from the Bingham Canyon watershed, although they continued to receive precipitation and local runoff from the Bingham Creek drinages below the Large Reservoir. Water from drainages above the Large Reservoir was discharged to the Ponds during the extreme wet periods of 1973-74, 1975-76, and 1983-84. In 1983, additional clay-lined ponds were constructed, and one of the previously existing ponds was clay lined. During the most recent periods of discharge to the Ponds, some of the waters were treated with lime before discharge. The Ponds have not been used for process water diversion since 1984.

The Site contains pond waste in 21 individual ponds covering approximately 375 acres (Figure 1). The individual ponds are separated by earthen embankments and, with the exception of the most recently constructed ponds, are unlined. All of the ponds have been drained, and some have been treated with lime, capped and revegetated. Ponds A-D received tailwater, mine waste, and storm water. Ponds 1-7 received storm water only (Figure 1).

The Site lies on a gravel bar along the shoreline of historic Lake Bonneville, and is underlain at shallow depth by these shoreline deposits and alluvial materials (Kennecott 1991). There has been seepage from the Ponds, and the underlying ground water system may have been impacted by seepage of stored pond water. The Ponds are susceptible to infiltration of incident and collected precipitation. The sediments in the Ponds have formed a crust that appears to minimize blowing dust.

In 1992, Kennecott built a desilting basin in Bingham Creek at the point of diversion for the Evaporation Pond Canal. The purpose of the desilting basin is to settle out tailings eroding from ARCO's tailings ponds just west of Highway 111. This basin has stopped the migration of their tailings to the Evaporation Ponds.

Total metals analyses of the pond wastes indicate detectable concentrations of metals including arsenic, copper, lead, and zinc. However, initial batch leach testing indicates that the pond waste has only a limited potential to leach metals into the subsoils (ASCI/ABC 1990).

1.2 PURPOSE

The purpose of the solid phase portion of this investigation is to trench and bore to obtain solid samples of pond materials that can be used to characterize the nature of potential hazards to human health and the environment and to photograph and document these activities. The level of detail will be sufficient to support an analysis for potential remedial actions. This Work Plan describes the site-specific sampling and analysis tasks required for site characterization, including the sample types, locations, frequency, sample handling techniques, decontamination procedures, planned analyses and required documentation.

1.3 OBJECTIVES

Key geochemical and engineering items to be assessed during this site characterization include:

- Characterization of the pond waste geochemistry by depth and individual ponds to assess which ponds may be reclaimed by direct revegetation and which ponds may require more thorough remediation (capping, for example).

- Assessment of potential migration depth of metals and other constituents in the pond area beneath the pond waste, and the degree of attenuation of these constituents by the site subsoils.

- Measurement of the depths to enable calculation of the volumes of waste in each Pond. The majority of backhoe trenches excavated in 1990 (ACSI/ABC 1990) did not reach the "bottom" of the ponds (i.e., underlying native soils). As a consequence, much of the early, untreated waste and sediments were not included in that sampling.

- Assessment of the load bearing capacity of the mine waste to support vehicle traffic for topsoil placement and revegetation activities. Observations in 1990 were that most of the Ponds could be accessed with rubber-tired vehicles. However, some of the pond wastes were sufficiently wet to preclude rubber-tired vehicle traffic, and special access procedures or equipment may be required to allow remedial activities. Some of the equipment access issues will be tested as part of this program.

As part of the process of characterizing the Site, the following specific information will be collected or determined:

- Lithology of each individual pond.
- Volume of waste for each individual pond and the entire Site.
- Lithology and chemical composition of native soils underlying each pond.
- Geochemical properties of the waste in each of the impoundments at the Site.
- Geochemical impact of the pond wastes on the underlying native soils.

1.4 DOCUMENT ORGANIZATION

The Work Plan is composed of the previous text and following appendices:

- Air Monitoring Plan (Appendix A)
- Health and Safety Plan (Appendix B)
- Sampling and Analysis Plan including the Quality Assurance Project Plan (Appendix C)

1.5 KEY PERSONNEL

The following personnel will be responsible for all project activities.

Project Director:	Richard Burris
Project Manager:	Brian Vinton, NAE
Project QA/QC Officer:	Asim Mukherjee, PPG
Task Leaders:	John Birkinshaw, Larry Elkin, NAE

1.6 STANDARD ANALYTICAL TECHNIQUES

Chemical analysis will be performed in accordance with Methods for Chemical Analysis of Water and Waste (EPA 1983) and with "Test Method for Evaluating Solid Waste" under SW-846 (EPA 1986).

1.7 SCHEDULE

The following outlines the schedule for major tasks and deliverables.

October 29 through November 15, 1993	Trenching of all Ponds
November 15, 1993	Bulk Sampling
November 22, 1993 through January 10, 1994	Initial chemical analysis
January 30, 1994	Preliminary draft report of lithologic findings
March 15, 1994	Preliminary draft report of chemical analytical results

1.8 REFERENCES

ASCI/ABC, 1990, Geochemical Evaluation of Evaporation Pond Materials, Kennecott Utah Copper Division, Salt Lake City, Utah: Technical Report, October, 12 p.

Kennecott, 1991, Environmental Action Project Plans: Report to U.S. EPA, Region VIII, Kennecott Corporation, June.

U.S. Environmental Protection Agency, 1983, Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020, March, 1979, revised March 1983.

U.S. Environmental Protection Agency, 1986, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, September.

APPENDIX A

AIR MONITORING AND ANALYSIS PLAN

A.1.0 INTRODUCTION

Kennecott Utah Copper will be conducting investigations and potential remediation projects at the South Jordan Evaporation Ponds during the 1993 and 1994 calendar years. This air monitoring plan will be part of individual, site-specific work plans and presents the methodology to be used by Kennecott for conducting air sampling. If additional site-specific air monitoring information is required for a particular project or specific work tasks, an addendum will be attached to this plan.

Air monitoring samples will be collected at selected areas and for project personnel to monitor for airborne emissions during investigative tasks. The sampling frequency will be based on the initial analytical results. The sampling will be conducted using hi-flow battery powered personnel sampling pumps and hi-volume ambient air pumps. Both of these pumps draw air through sampling media that is analyzed for the constituents of concern. The quantitative air sampling will be used to monitor employee exposures and work zone boundaries. Miniature real-time aerosol monitors (Miniram) may be used when immediate results are needed for respirable dust.

The purpose of air monitoring is threefold:

- Document employee exposure, if any;
- Document potential work-zone particulate emissions; and
- Evaluate the effectiveness of dust control methods.

A.1.1 BACKGROUND AIR SAMPLING PROCEDURES

Background air samples will be collected prior to any site activities. Previously collected data may serve as background data. The availability and useability of historical background data will be evaluated on a case-by-case basis. Hi-flow (2.0 L/min) and/or hi-volume (20.0 L/min) samples will be collected at the site if necessary. The background samples will be used to determine a suitable reference data base for comparison with airborne particulate and metal concentrations measured during the project.

A.1.2 PERSONAL AIR SAMPLING PROCEDURES

Personal monitoring will be performed with hi-flow personal battery powered sampling pumps drawing air through sampling media following National Institute for Occupational Safety and Health (NIOSH) methodologies. The number of personal samples collected will be based on NIOSH recommendations and good industrial hygiene practice. Sampling procedures may be altered at the discretion of field sampling personnel as site-specific conditions warrant. NIOSH sampling results are quantitative and will be used to document site air quality and potential worker exposures. MINIRAM monitors may be used to qualitatively measure personnel exposures.

A.1.3 WORK ZONE SAMPLING PROCEDURES

Air samples will be collected at the work zones to determine particulate emission concentrations and document work zone air quality. The samples will be collected with both hi-flow and hi-volume (if necessary) sampling pumps drawing air through sampling media following National Institute for Occupational Safety and Health (NIOSH) methodologies. Sampling procedures may be altered at the discretion of field sampling personnel as site-specific conditions warrant. MINIRAM monitors may be used to qualitatively measure work zone and perimeter emissions.

A.2.0 AIR SAMPLING PROCEDURE

The following standard operating procedure (SOP) will be followed for all quantitative sampling conducted.

A.2.1 AIR SAMPLING SEQUENCE

The following procedures will be followed for all collected air samples.

1. Fill out logbook header at the beginning of the day;

2. Calibrate sampling pumps;

3. Connect filter cassette to pump, remove the inlet plug from filter cassette and turn on pump;

4. Document initial information about the individual samples and conditions in a field logbook, including calibrations, start times, locations and a map or diagram; and

5. Ensure required quality assurance field blank (1 per 10 samples) is opened and placed near a sampling pump (field

blank) or a trip blank is carried during sampling routine.

At days end:

6. Turn off pumps, record stop time in field log, and plug cassettes;

7. Recalibrate pumps and record information in both the field logbook and the calibration documentation forms;

8. Place the pumps on charge overnight;

9. Prepare chain of custody forms for all samples; and

10. Either securely store or, package and ship samples, including chain of custodies.

Sequence events are described in detail in the following sections.

A.2.2 LOGBOOK HEADER

An up-to-date sampling field notebook will be maintained by project personnel during all sampling activities. The general information recorded for each day's sampling includes:

- Date;
- Name of overall sampling event;
- Sampling personnel;
- Climatic conditions; and
- Equipment location and operating times.

Any other pertinent information will be recorded in the field notebook.

A.2.3 PUMP CALIBRATION

Air pumps will be calibrated on a quarterly basis using a graduated buret and a soap solution or other commercially accepted primary standard calibration device. With the first method, the pump is hooked up to an inverted buret, air is drawn through the open mouth of the buret, and a soap bubble is formed with a soap solution across the buret mouth. As the bubble is drawn up the buret across two pre-determined graduations, a stopwatch is used to record the elapsed time. From the graduated volume and elapsed time, the volume per time, or flow rate, can be calculated. The pump flow rate can then be adjusted as desired. Enter this calibration data on a calibration form as documentation. If a primary calibration device other than a buret is used, the pumps will be calibrated according to the manufacturer's protocol.

Daily pump calibrations will be conducted using a secondary calibration device such as a rotometer. The rotometer must be calibrated against a primary standard. A calibration curve is then developed between the two standards.

A.2.4 LOGBOOK SAMPLE ENTRIES

Quality assurance and quality control (QA/QC) procedures for air sampling require completion of a sampling log. For each sample collected (including blanks), the field sample logbook and office logs must contain:

- Sample number;
- Sampling location;
- Start and stop calibrated air flows;
- Average air flow;
- Start and stop time;
- Sampled volume;
- Sampling method (i.e. NIOSH);
- Field observations; and
- A map or diagram.

Significant deviations from sampling protocol shall be formally noted in the field log, along with visiting personnel and any unusual circumstances which might affect the sampling.

A.2.5 QC BLANKS

One QC blank should be submitted with each 10 samples (10%). The blanks are unsampled cassettes that are returned to the lab with the other samples as a test for contamination during sampling and transport. Quality control procedures are outline in following sections.

A.2.6 CASSETTE LABEL

To prevent sample misidentification, each sample cassette is affixed with a label. The following information will be recorded on the sample container:

- Date sample collected;
- Sampling pump identification number;
- Sample cassette number; and
- Chain-of-custody number.

A.2.7 CHAIN OF CUSTODY

To establish the documentation necessary to trace sample possession from the time of collection, a chain-of-custody record will be filled out for each sample and accompany every set of samples. The record will include the following:

- The project number;
- Air sample analysis request;
- Sample number;
- Flow rate;
- Length of sampling time;
- Signature of the collector;
- Sample date;
- Signature of person(s) involved in the chain of possession; and
- Time(s) and date(s) of change(s) of possession.

A.2.8 SAMPLE PACKAGING AND SHIPPING

Samples will be packaged in clean areas that are remote from potential contaminant sources. Packing material will be used to stabilize the cassettes during shipment, if necessary. Samples will be picked up, delivered or shipped for analysis once a sufficient amount of cassettes have been collected.

A.2.9 ANALYTICAL METHODS

The air samples collected using NIOSH methods will generally be analyzed for lead and arsenic (as indicator metals), and total airborne dust (see Appendix B, section 3.2). Other sampling upon request may include silica, asbestos, other metals, or any other constituent of concern. Samples will be analyzed using NIOSH standard methods. Samples for total airborne dust will be collected using cassettes containing pre-weighed filters, and will be analyzed gravimetrically.

A.3.0 QUALITY ASSURANCE AND QUALITY CONTROL

The purpose of data quality assessment is to confirm that data generated during the QA program is accurate and consistent with program objectives. The quality of the data will be assessed based on accuracy and completeness. Accuracy is a determination of how close the measurement is to the true value and will be assessed by the cleanliness of blanks. Completeness is a measure of the amount of valid data obtained, compared to the amount that was expected under normal conditions. Ninety (90%) percent completeness is the goal of Kennecott air monitoring. The project data objectives for accuracy and completeness are consistent with guidelines established by NIOSH and OSHA.

A.3.1 SAMPLING CALIBRATIONS

Personal sampling pump flow will be calibrated following NIOSH protocol. The pumps will be calibrated at the beginning and end of sampling each day. The cassette used for pre-calibration will also be used for post-calibration. The two calibrations must be within 20% of each other or the day's sampling for that pump will be invalidated.

A.3.2 QC SAMPLES

Internal quality-control checks will be conducted to evaluate the quality of data based on field conditions and constraints. The field QA/QC program will be conducted in addition to laboratory QA/QC. The following quality-control checks will be performed:

- Field Blank - Opened but unsampled filter cassette placed near an active sampler. The cassette is closed and returned to the lab with the other samples as a test for contamination during sampling and transport.
- Trip Blank - Unopened cassette that is subject to the same handling as sampled cassettes. The trip blank is returned to the lab as a test for contamination during handling and/or prior to receiving the cassette from the lab.

The above internal QC samples will be evaluated to determine if the field and transport procedures are adequate to provide valid analytical data. One field blank or trip blank will be collected and analyzed for each 10 samples. The evaluation process for data from QC samples is outlined below.

A.3.3 DATA REDUCTION, VALIDATION AND REPORTING

All data will be reported in appropriate units. All raw data will be reviewed and validated against calibration records to ensure that data are reliable and that the data are in compliance with QA/QC objectives. Upon completion, a copy of the signed laboratory report will be retained for future reference. Raw data from field measurements and sample collection activities that are used in project reports will be appropriately identified.

QC records, showing accumulated precision and accuracy data, will be maintained in the laboratory and reported along with analytical results. Poor quality results require that the problem be determined and corrected in a timely manner.

A.3.4 CORRECTIVE MEASURES

If QC system or performance audits detect conditions or data that do not meet QC requirements, corrective action will be initiated. The nature of the action will depend on the circumstances of each situation and may include:

- Evaluating and amending sampling and analytical procedures; and
- Accepting data, acknowledging level of uncertainty.

Any corrective measures taken during the monitoring program will be described in the monthly and final reports.

A.3.5 QA REPORTS TO MANAGEMENT

Final field and laboratory reports will be submitted to the QA/QC Officer for review; issues requiring clarification will then be addressed. Following review by the QA/QC Officer, final field and laboratory reports will be submitted to the Project Manager on a monthly basis and at the completion of individual projects. The reports will include the following:

- Total number of samples collected for the month/project;
- Total number of samples voided for the month\project;
- Total number of blanks for the month/project;
- Percent blanks and percent complete for the month/project;
- Number of days lost due to weather or other unforeseen circumstances;
- Text description of project activities.

APPENDIX B

HEALTH AND SAFETY PLAN

B.1.0 INTRODUCTION

This Health and Safety Plan (HASP) applies to activities related to Kennecott South Jordan Evaporation Ponds investigative activities. The work will be conducted by employees, contractors, and subcontractors of Kennecott. This Health & Safety plan will be available at all times at the work area for review by employees, contractors, subcontractors, regulatory agencies, or representatives thereof. All visitors and regulatory personnel are expected to be familiar with and comply with all aspects of this Health and Safety Plan.

This HASP is designed to identify, evaluate, and control health and safety hazards associated with Kennecott Plant Projects Group investigative work at the South Jordan Evaporation Ponds. The plan is based upon existing information regarding the entire site (properties east of Bingham Pit), similar work conducted to date on Kennecott property, and past experience at other sites. Addressed are specific safety and health hazards and procedures necessary to protect the employees conducting the various project activities. If an individual project has a health and safety issue or circumstance that is not addressed in this plan, an addendum will be provided when the issue is identified.

In the event site conditions change, sections of the HASP may also change, and will then be subject to approval by the Health and Safety Officer (HSO). Any changes will be communicated to all employees.

B.2.0 COMPREHENSIVE WORK PLAN

A comprehensive Work Plan for the operations to be conducted precedes this HASP. The Work Plan describes work tasks, objectives, personnel requirements, and methods for conducting investigative activities.

B.3.0 JOB HAZARD ANALYSIS

The potential hazards associated with site activities include both chemical and physical hazards. Equipment operators and laborers directly involved in day-to-day project activities have the greatest potential for exposure to these hazards. Site scientists and supervisors generally have lower potential exposure to these hazards.

If judged by the HSO to be necessary, a Job Hazard Analysis will be performed at the HSO's direction. General categories of potential hazards may include those listed in this section.

B.3.1 PHYSICAL HAZARDS

This section describes normal physical construction site hazards.

B.3.1.1 Heat Exhaustion

Heat exhaustion occurs when the body loses so much water and electrolytes through very heavy perspiration that fluid depletion (hypovolemia) occurs. For sweating to be an effective cooling mechanism, the sweat must be able to evaporate from the body surface. If evaporation does not take place, cooling will not occur. Heat exhaustion is a potential hazard associated with elevated body temperatures caused by high ambient air temperatures and high humidity, heavy physical labor, wearing personal protective equipment, and/or any combination thereof. This hazard will be evaluated on a day-to-day basis by the Construction Superintendent and Health and Safety Officer.

B.3.1.2 Cold Exposure

Cold injury (frostbite and hypothermia) and impaired work ability are potential hazards at low ambient air temperatures and/or when the wind chill factor is low. The symptoms associated with cold exposure are excessive shivering, loss of control of muscle activity, lethargy and loss of interest in combatting cold, and finally, decreased vital signs. This hazard will be evaluated on a day-to-day basis.

B.3.1.3 Inclement Weather

Rain, snow, extreme low or high temperatures, or high winds may occur during scheduled work activities. All employees will be trained in the hazards of exposure to cold and/or wet conditions. Protective clothing for cold and/or wet, slippery conditions will be used when needed. Severe weather conditions may result in cessation of work activities at the discretion of the Project Manager, Construction Superintendent or Health and Safety Officer.

B.3.1.4 Utility Lines

Overhead utility lines are present near the work area but should not pose a hazard. All operators and ground personnel should always be aware of all overhead hazards and warn each other of potential danger. All underground utilities will be located and clearly marked prior to excavation. A close proximity permit from Kennecott will be obtained when any large piece of equipment must operate within 10 feet of an energized line.

B.3.1.5 Noise

Exposure to elevated noise is expected for heavy-equipment operators and, potentially, some ground personnel. This hazard will be controlled by wearing the appropriate level of hearing protection. Either ear plugs or earmuffs will be encouraged for heavy-equipment operators, laborers, and any other personnel working near the equipment. The Health and Safety Officer will assist in determining the proper level of hearing protection to be worn by site personnel.

B.3.1.6 Construction

As on all construction sites, there is potential for personal injury. American National Standards Institute (ANSI) approved equipment will be required. Hard hats, steel toe boots, and safety glasses will be required to guard against head, foot, and eye injuries. All required construction equipment will have appropriate audible or visual warning alarms. Applicable MSHA and OSHA regulations will be followed and enforced.

The excavation standard outlined in 29 CFR 1926 will be adhered to at all times. A competent person shall inspect all excavations that personnel must enter to ensure proper sloping has been achieved. An excavation permit must be obtain from Kennecott and signed by the HSO.

B.3.1.7 Dust Suppression

Dust may be generated during excavation, transportation and placement of material. Water spray, tarping of transport vehicles, or other controls will be used, as necessary, to control dust levels. Air monitoring will be conducted to ensure that occupational exposures to emissions from work areas are below accepted safe levels.

The OSHA time-weighted average (TWA) for silica (SiO_2) 0.05 milligrams per cubic meter (29 CFR 1910.1000). The OSHA Permissible Exposure Limit (PEL) for total suspended particulate (TSP) is 15,000 micrograms per cubic meter in air for any 8-hour time-weighted average (29 CFR 1910.1000).

B.3.1.8 Other Physical Hazards

Other physical hazards such as insect bites, stings, etc. may occur during investigation operations. Precautions will be taken to prevent these hazards.

B.3.2 CHEMICAL HAZARDS

Based on available information regarding the site, metals of concern identified in the pond deposits are arsenic and lead. Other metals are present but arsenic and lead have been selected as hazard indicators due to their low action levels (AL) and PELs. If additional chemical hazards become evident, such as silica, appropriate measures will be taken to monitor and protect the health and safety of personnel on the site and prevent off-site migration. All employees will be notified of any new hazards as they become known.

B.3.2.1 Arsenic

Arsenic is a solid material with no odor. Potential exposure routes are through inhalation or ingestion. Skin contact can also result in adverse effects. Some arsenic compounds may cause irritation of the eyes, mucous membranes, respiratory system, and skin. Dermatitis can also result from poor personal hygiene when working around these materials. Excessive inhalation of arsenic may result in respiratory problems such as coughing and chest pain. Other symptoms include giddiness, headache, and extreme weakness preceding gastrointestinal irregularities. Prolonged exposure can result in weight loss, nausea, diarrhea, pigmentation of skin, and loss of hair. Arsenic is considered a carcinogen; a cancer-causing substance.

The OSHA AL for arsenic is 5.0 micrograms per cubic meter in air for an 8-hour time-weighted average (29 CFR 1910.1018). The OSHA PEL for arsenic is 10 micrograms per cubic meter in air for an 8-hour time-weighted average.

B.3.2.2 Lead

Lead is a solid material with no odor. Potential exposure routes are through inhalation or ingestion. The early effects of overexposure to lead are nonspecific and are difficult to distinguish from the symptoms of minor seasonal illnesses, except by laboratory testing. The symptoms are decreased physical fitness, fatigue, sleep disturbance, headache, aching bones and muscles, abdominal pains, and decreased appetite. More advanced effects include anemia, pallor, a "lead Line" on the gums, and decreased hand grip strength. Lead colic produces intense abdominal pain with nausea and vomiting. Headache, convulsions, coma, delirium, and kidney damage can occur. Lead is not considered a carcinogen but it is classified as a reproductive toxin and a teratogen (fetal malformation).

The OSHA AL for lead is 30 micrograms per cubic meter in air for an 8-hour time-weighted average (29 CFR 1910.1025). The OSHA PEL for inorganic lead is 50 micrograms per cubic meter in air for an 8-hour time weighted average.

B.3.3 HAZARD MITIGATION

The hazards identified in the above sections, and any additional hazards which arise or are identified during work activities will be mitigated by personal protective equipment (PPE), engineering controls, and other safety procedures. Physical hazards will be mitigated by the implementation and enforcement of standard operating procedures described in Section 9.0. Chemical hazards will be identified through the air monitoring program described in Section 7.0 and mitigated by the use of PPE, engineering and site controls.

B.4.0 PERSONAL PROTECTIVE EQUIPMENT

Occupational exposures to arsenic, lead, and TSP are expected to be well below action levels specified in CFR 1910.1018, 1025, and 1000, respectively. Therefore, the level of personal protection to be utilized for all initial site activities is Level D. Level D personal protective equipment (PPE) shall consist of a hard hat (ANSI Z89), safety glasses (ANSI Z87), steel-toed boots (ANSI Z41 with substantial leather 6-inch uppers) and cotton coveralls. Gloves and hearing protection may be required for task specific work. Work zone visitors will be required to wear applicable safety equipment depending on the duration and extent of involvement at the site. The level of protection will be adjusted according to results of employee exposure monitoring, specific job functions, or as site conditions change.

B.5.0 TRAINING REQUIREMENTS

The Kennecott Health and Safety Officer will be responsible for deciding which oversight agency , MSHA or OSHA, has jurisdiction for each project. There may be instances where both agencies will have enforcement jurisdiction.

All employees and supervisors working in excavation of contaminated materials will be required to have 40 hours of hazardous substance training. These employees will receive a minimum of 24 hours of on-the-job-training. Copies of training certificates and other training documentation will be submitted to the Kennecott Safety Officer and will also be kept on file near the job site.

Project employees performing work that is subject to MSHA regulations, will receive Newly Employed Experienced Miner Training, as defined by MSHA regulations. These employees will be required to demonstrate that they have job related experience. If employees do not have job-related experience, they will be required to receive New Miner Training, as defined in MSHA regulations. These project employees not subject to MSHA, will be required to receive all new-hire orientation training as specified in the OSHA regulations. All employees and supervisors working in the excavation of contaminated material will be required to have 40 hours of hazardous substance training. Certificates and training documentation should be kept near the job site.

Employees will be trained to a level required by their job function and responsibility before being permitted to engage in field activities. Pre-employment safety information will include:

- Names of personnel and alternates responsible for site safety and health;
- Chemical and physical hazards present on the site;
- Work practices by which risks from hazards can be minimized;
- Detailed review of this HASP and Kennecott Emergency Protocols;
- Safe use of engineering controls and equipment on the site;
- Use of personal protective equipment; and
- Medical surveillance requirements, including recognition of symptoms and signs which might indicate overexposure to hazards.

Site safety meetings (tailgate meetings) will be held at least weekly to notify personnel of specific hazards, air monitoring results, changes in the HASP, or other topics determined by the Health and Safety Officer and Construction Superintendent. Specific meetings will be held at the initiation of new or different field activities and at the time of any crew changes. Kennecott will conduct weekly supervisor planning/safety meetings.

B.6.0 DECONTAMINATION PROCEDURES

Equipment decontamination will be conducted on site as appropriate. Equipment decontamination will consist of physically removing visible contamination from contact points of the equipment at completion of work tasks and before leaving the work area. The removed material will remain in the work zone. Equipment can be decontaminated at the Kennecott decontamination station if it is close enough to work activities or can be transported to the station without contaminating roads.

Personal decontamination will consist of removing and leaving outer PPE at the work zone or safety trailer and good personal hygiene. Employees will be required to wash with soap and water at each break, lunch period and at the end of the work shift. Facilities for decontamination may be provided on-site for particular jobs, as judged by the HSO to be necessary.

Decontamination procedures will be monitored by the Health and Safety Officer to determine their effectiveness. If such procedures are found to be ineffective, they will be altered to correct any deficiencies.

B.7.0 AIR MONITORING

Air monitoring will be conducted to evaluate the potential for employee exposure to airborne contaminants and to determine the overall contribution of work activities to ambient air quality, as specified in the Air Monitoring Plan, Appendix A. Prior to any activities on site, background air samples will be collected to establish a datum for site activities. During excavation and placement activities, quantitative and potentially qualitative air sampling will be conducted to determine employee exposures.

All air samples will be collected and analyzed according to the appropriate National Institute of Occupational Safety and Health (NIOSH) method for determining concentrations of arsenic, lead, and TSP (see Appendix A).

B.7.1 OCCUPATIONAL AIR MONITORING

Quantitative personal samples will be collected using constant-flow pumps that are calibrated using a rotameter or "bubble tube" to draw between 1.0 and 2.0 liters of air per minute or as specified in the Air Monitoring Plan. The samples will be handled under chain-of-custody procedures and delivered to a qualified laboratory for analysis (See Appendix A).

Employees with the highest potential for exposure will be selected for personal monitoring. At the start of field activities and periodically thereafter, occupational air samples will again be collected and analyzed for arsenic, lead and TSP. Additional air monitoring will be conducted whenever there is a change in work conditions which can be expected to result in new or additional exposure levels or whenever an employee complains of symptoms which may be attributable to exposure to lead or arsenic.

Qualitative work zone air monitoring may be conducted using real-time instruments which measure the light-scattering effect of particulates.

B.8.0 MEDICAL SURVEILLANCE PROGRAM

A medical surveillance program provides a means of selection of employees who are physically able to safely perform the work assigned and monitor their health on a regular basis. The medical surveillance program to be implemented for this project will comply with 29 CFR 1910.120(f).

The program consists of a pre-employment medical evaluation to determine fitness for the job assignment, an annual evaluation based on length of assignment or attending physicians opinion (no greater than biennially), and an end-of-employment evaluation. In addition, a special evaluation is warranted when an employee indicates that they may have developed symptoms resulting from a possible exposure to hazardous substances.

Medical surveillance will be conducted for all site personnel who may be exposed to arsenic and lead in excess of PELs, without regard to the use of respirators, for 30 days or more per year. All personnel participating in the medical surveillance program will have an entrance examination which equals or exceeds the following:

- Medical and Occupational History;
- Physical Examination;
- Pulmonary Function Test;
- Six Frequency Audiogram;
- Urinalysis, with microscopic morphology and dipstick;
- Complete Blood Count;
- CHEM 20 Chemistry Screen;
- SAM 9 Drug Screen;
- Chest X-Ray (examined by a 'B' reader); and
- Blood lead and total urine arsenic levels (speciation of total arsenic, will be performed if levels are greater than 50 $\mu g/L$, for exit examination only).

All contractor personnel with the potential for chemical exposure as outlined above are required to have medical monitoring which equals or exceeds this program. Visitors and regulatory personnel who will enter the work area other than in enclosed vehicles may be required to demonstrate participation in a medical program which is equivalent to or exceeds the standards of this program. The Health and Safety Officer will determine which personnel must meet training and medical-monitoring requirements.

Prior to the start of project activities, all employees with potential for airborne contaminant exposure will have a baseline evaluation conducted for lead levels in blood and urine arsenic levels (speciation, if necessary). These evaluations are to be repeated at the completion of work activities or at the end of employment. If an employee is removed from a project to conduct work at another site off Kennecott property, that employee shall receive an additional bio-metals exam before leaving and upon return to the Kennecott project, regardless of the off-site duration.

Copies of the physician's written opinion for the capability of the individual to work in areas with a potential for arsenic and lead exposure and the ability to wear a respirator will be maintained by the Health and Safety Officer for all workers on site. The completed and signed respirator fit test form will be kept in the same file.

B.9.0 STANDARD OPERATING PROCEDURES/SAFE WORK PRACTICES

Standard operating procedures and safe work practices for this project consist of Kennecott General Safety for Contractors, Kennecott Emergency Protocols, and the following:

- No alcohol, firearms, or illegal drugs will be allowed on Site.
- Any employee under a physician's care and/or taking prescribed medication must notify the Site Health and Safety Officer.
- Eating, drinking, smoking and chewing tobacco or gum are allowed only in designated areas and never in the removal work zone or at the dump site.
- All personnel shall listen for warning signals on construction equipment and shall yield to equipment.
- All equipment operators shall pay careful attention to workers on the ground who may be in their path and provide warning to these people before moving. All employees working regularly on the ground will wear orange vests with reflective tape. Operators shall also pay deliberate attention to all types of utility lines and sources.
- All personnel are required to be familiar with and abide by the security rules, and emergency procedures.
- All personnel must report any injuries, vehicle accidents, and/or illnesses to their supervisor. This includes minor or slight injuries.
- All newly hired employees must pass a pre-work assignment physical and subsequent exams as required by this plan.

- All personnel must participate in the air-quality exposure monitoring program by wearing personal monitors or sampling devices designated by the Site Health and Safety Officer.

- All personnel must abide by all safety rules and procedures as described in the work rules and/or throughout the project.

- Remember, safety starts with you.

B.10.0 NAMES AND NUMBERS OF KEY PERSONNEL

The following persons have been identified to oversee the safety and health of employees involved with Kennecott work activities:

Mr. Paul Riley - Kennecott Plant Projects Group Safety, Health and Safety Officer
Telephone - 569-7010
Mobile - 580-1497
Pager - 481-3842
Radio - #3-13

Fire/Medical Emergency - 569-6211

Copperton Clinic - 569-6095

Contractor Site Superintendent

Contractor Designated Safety Director

Signature Form

By signing below, I have read and understand the Health and Safety Plan above and the attached referenced documents. I will abide by all safety guidelines established herein.

APPENDIX C

SOIL SAMPLING AND ANALYSIS PLAN

C.1.0 FIELD SAMPLING PLAN

The scope of work consists of the following technical activities:

- Two to four trenches will be excavated in each Pond (Figure 1).
- Four to five trenches will be excavated proximal to the Ponds (Figure 1).
- The lithology of each trench will be mapped and sampled.
- The native soils below the pond waste will be sampled and mapped in each trench.
- Each trench will be surveyed. Lithologies in the trench will be referenced to the surveyed surface location (Figure 1).

C.2.0 Sampling Objectives

The objective of the soil sampling program is to determine the physical and geochemical characteristics of pond waste at the Site. The data to be collected during the soil sampling program includes the following:

- Lateral and vertical distribution of pond waste;
- Location and chemical characteristics of the contact between pond waste and native soils; and
- Concentrations of metals of concern (Table 1) in the pond waste and native soil.

C 2.1 Sampling Locations and Frequency

The tailings/sludge material will be collected from trenches in each of the individual ponds as depicted in Figure 1. Additional locations may be designated in the field after initial results are obtained. Sample collection will commence November 9, 1993.

C 2.2 Field Standard Operating Procedures

The sampling will be accomplished using a back-hoe. The following will be done at each pond:

- Trenches will be located and accessed from the corner of each pond.
- Minor pad work may be needed to support the weight of the backhoe.
- Geologic correlation of wastes, i.e. sludge and tailings, will be drawn for each pond to show stratigraphic continuity and will be used to calculate volumes for each lithology type.
- Discrete samples, i.e., each lithology, will be collected and mapped for each trench.
- Samples will also be collected as a function of depth. Each consecutive vertical foot will be sampled in each trench.
- Initially, three to five trenches selected from all trenches will be submitted for chemical analysis.

C.2.3 Lithologic and Geochemical Characterization

Lithologic and geochemical characterization of Evaporation Pond waste sediments and underlying native sediments will be necessary for a comprehensive evaluation.

Two sets of samples will be collected for each trench:

Sample 1. Sample will be collected as a function of lithology.
Sample 2. Sample will be collected as a function of depth.

C.2.3.1 LITHOLOGY GUIDED SAMPLING

Lithologies including pond wastes and underlying native soils and/or clay liner will be sampled separately. All units will be sampled as continuous channel samples each weighing 3 pounds.

Sludge: Several types of sludge may be encountered. Sludge lithology will be sampled as distinct units based upon color, texture or visual composition. Vertical sample intervals will not exceed 3′ and will be greater than 2", i.e, when vertical sludge intervals are greater than 3′, more than one sample will be collected and when less than 2" thick partings occur (tailings or limey sludge), the < 2" thick interval will be incorporated with the ≤ 3' thick interval sampled.

Tailings: Any interval of tailings greater than or equal to 2" in thickness will be sampled as a distinct unit. Tailings thicker than 3' will be sampled as more than one sample.

Clay Liner: The clay liner, if in existence, will be sampled as a separate lithology. Liner material will probably be less than 3' in thickness and sampled as one channel composite. If greater than 3', it will be divided into more than one sample where no sample exceeds 3' in thickness.

Underlying Alluvium: Underlying alluvium beneath sludge/tailings or clay liner will be sampled as 1' to 3' channel samples, dependent upon field observations that determine leached horizons precipitated from overlying wastes.

C.2.3.2 SAMPLE AS A FUNCTION OF DEPTH

Each trench will be sampled along with lithologic sampling, as 1' thick vertical channel samples beginning at the top of each trench. The 1' intervals will be sampled continuously through the sludge and tailings, regardless of lithology until the clay liner and/or natural ground is encountered. Sampled thickness immediately above the liner or natural ground may be less than 1'. Approximately three pounds of material will be collected for each sample.

Natural ground will be sampled on 1' intervals through the depth limit of the trench.

C.2.3.3 SELECTION OF TRENCH SAMPLES FOR CHEMICAL ANALYSES

Upon completion of sampling, lithology types, distribution and thickness will be reviewed. This review will provide a subsequent decision in terms of which trench(s) will best represent the lithology for any given Pond(s). After these decisions have been made, the samples collected for lithology will be chemically analyzed. Analytical parameters are discussed later in this document. Generally, the Ponds can be grouped into the following types according to their usage and respective deposition material:

1) Tailwater and tailings (untreated)
2) Tailwater and tailings (treated)
3) Storm water
4) Seeps from upgradient ponds into "seep ponds"
5) Combinations of #1 through #3

The most lithologically representative trenches and corresponding samples from the various pond types will be analyzed. This will include approximately 7 samples per trench multiplied by approximately five types for a total of 35 samples. Depending upon results, additional samples may be submitted for analysis.

If a high degree of variability for the various lithologies is determined in the pond, additional trenches may be excavated, starting at the ingress of mine wastes into the pond and moving away from this point, as there may be a deltaic deposition pattern.

In addition to trenches within the pond, several areas have been noted where plant growth is stunted or absent. These areas will be trenched and sampled with the same protocol as the ponds.

C.2.3.4 Sample Collection Procedures

The solid samples will be collected using disposable plastic or decontaminated stainless steel hand tools. The quantity of material sampled at each subsite will be approximately three pounds unless specified. Sample containers will be 12" x 17" polyethylene or zip lock bags. Polyethylene bags will be taped closed and labeled after sample collection.

Surface soil samples will be collected from 0-4 inches at the sampling location. Sampling bias will be avoided by collecting both the fine and coarse fraction; sampling will attempt to collect material representative of solids in the field.

Generation of Composite. Material will be composited from each stratigraphic interval to form a single sample. Composite sample mixing will occur by thoroughly shaking the sample in a vertical and horizontal motion or thorough mixing in a stainless steel bowl. If material is wet, it will be dried at the laboratory and homogenized.

Split Samples. If split samples are required, they will be obtained in the following manner:

- Collect sufficient sample material following the above procedures. Enough material must be collected to provide a field split for archiving. If soil conditions are such that a representative split sample cannot be attained (muddy/extremely wet conditions), a duplicate sample will be provided. A duplicate sample is collected from the same subsite locations.

- The remaining sample portion, enough to produce three evenly proportioned samples, will be delivered to the analytical laboratory.

C.2.3.5 STORAGE OF REMAINING SAMPLES

Presently, the samples collected on a foot-by-foot basis and remaining lithologic samples, which will include several hundred samples, are being stored in the Connex in the PPG laydown yard. Samples are under chain-of-custody and will be available for further testing if additional chemical results are necessary.

C 2.4 Sample Handling and Documentation

The following sequence of events will be followed for all collected soil samples.

1. Fill out logbook header at the beginning of the day;

2. Document initial information about the individual samples and conditions in a field logbook, including a map or diagram;

3. Label container with sample number, date, time, any comments, and samplers' initials;

4. Collect the sample. As a precautionary measure always collect twice the required sample volume;

5. Place soil samples in separate sample containers;

6. Record sample description in the field logbook; and

7. Ensure required duplicates, splits and other QA/QC samples are included (10 percent, i.e. every tenth sample).

At days end:

8. Prepare chain-of-custody forms for all samples;

9. Package and deliver or ship samples, including chain of custodies.

Each sequence event is described in detail in the following sections.

C.2.4.1 Logbook Header

An up-to-date sampling field notebook will be maintained by on-site personnel during all sampling activities. The general information recorded for each days' sampling event includes:

- Date;
- Name of overall sampling event;
- Sampling personnel; and

- Climatic conditions.

C.2.4.2 Logbook Sample Entries

QA/QC procedures for soil sampling require completion of a field sampling log. The sampling log is an extremely important piece of documentation and should be completed with great attention to detail. For each sample collected, the logbook must contain:

- Sample number;
- Location with measurements if necessary;
- Time;
- Sampling method;
- Field observations; and
- Map or diagram.

Significant deviations from sampling protocol should be formally noted in the field log, along with visiting personnel and unusual circumstances which might affect the sampling.

C.2.4.3 Container Label

To prevent misidentification of samples, each sample container will be affixed with a label. Labels will be written with indelible ink and will be sufficiently durable to remain on the container. The following information will be recorded on the sample container:

- Sample identification number;
- Initials of sampling personnel;
- Date and time of collection; and
- Location and other pertinent comments.

C.2.4.4 Chain-of-Custody

Chain-of-custody forms must be available in the field. If for any reason, the sampling foreman must leave, he should sign off of the chain-of-custody form and his assistant or replacement should sign on and assume responsibility for sample custody.

To establish the documentation necessary to trace sample possession from the time of collection, a chain-of-custody record will be filled out and accompany every set of samples. The record will include the following:

- List of sample numbers;
- Signature of collector;
- Date and time of collection;
- Sample types;
- Number of containers;
- Parameters requested for analysis for each sample;

- Signature of person(s) involved in the chain of possession; and
- Inclusive dates of possession.

C.2.4.5 Sample packaging and shipping

Sample preparation and packaging will be conducted in clean areas that are remote from potential contaminant sources. The soil sample containers will be cleaned and secured in shipping containers. Packing material will be provided to stabilize the shipping containers if necessary.

Samples will be delivered to the laboratory daily or when an appropriate number of samples have been collected. In cases where samples will leave the immediate control of project personnel, a seal will be affixed to the sample container to ensure that the samples have not been disturbed during storage or transportation. The integrity of the seal will be observed and documented upon arrival at the laboratory.

C 2.5 Decontamination

All non-disposable sampling equipment will be cleaned when moving to a different sampling point to prevent cross-contamination. All samples will be collected with disposable plastic spoons. In the event if hand tools are needed, the equipment decontamination procedures are as follows:

1. Remove gross contaminants;
2. Wash with Algonox or other lab soap;
3. Rinse with tap water;
4. Triple-rinse with deionized water;
5. Repeat all or part of the procedure, if necessary.

Field personnel conducting the equipment decontamination and sampling will be required to wear protective gloves and the personal protective wear required under the HASP. The decontamination procedures used will be recorded in the field logbook.

C 2.6 Sample Analysis

All initial samples from the most representative trenches will be analyzed for:

1) Total contents for Ag, As, Ba, Cd, Cr, Cu, Fe, Hg, Pb, Se, total Sulfate, Chloride and Paste pH.

2) RCRA metals and sulfate using EPA Method 1312 (Table 2).

Should samples fail Method 1312, then Acid Producing Potential, and Acid Neutralizing and Generating Capacity Measurements will be performed.

TABLE 1

ANALYTICAL METHODS (TOTAL ANALYSIS)

Parameters	Method #	Detection Limit (mg/Kg)
Ag	6010	0.5
As	7060	0.15
Ba	6010	0.5
Cd	6010	0.2
Cr	6010	0.2
Cu	6010	0.5
Fe	6010	2.5
Hg	7470	0.01
Pb	6010	2.5
Se	7740	0.1
Zn	6010	0.5
Paste pH	9045/150.1	0.1
SO_4(T)	6010/300.0	5.0
Cl	9056/300.0	5.0
SO_4(L)	9056/300.0	5.0

TABLE 2

LEACHABILITY - (1312 SPLP)

PARAMETERS	EPA METHOD	DETECTION LIMIT (mg/Kg)
Ag	6010	0.5
As	7060	0.15
Ba	6010	0.5
Cd	6010	0.2
Cr	6010	0.2
Hg	7470	0.01
Pb	6010	2.5
Se	7740	0.1
Zn	6010	0.5
Cu	6010	0.5
SO_4(L)	9056/300.0	5.0

Additional tests will be performed to quantify the unique properties of the sludge and/or tailings where it can be stabilized chemically and physically. This portion of the investigation will involve possible mixing of sludge and/or tailings with various types of alluvial materials. Several bulk samples will be collected during the trenching exercise to facilitate this study.

Additional sampling may be required in a follow-up sampling phase (an addendum will be written and attached, if necessary). This may be accomplished with a truck mounted auger rig where geotechnical assessment can be made on in place lithologies below the ponds or a portable auger drill may be incorporated to collect samples from tailings and sludge within a pond.

C.3.0 QUALITY ASSURANCE PROJECT PLAN OBJECTIVES

The purpose of data quality assessment is to assure that data generated under the QA program are accurate and consistent with program objectives. The quality of the data will be assessed based on precision, accuracy, completeness, representativeness, and compatability.

> <u>Precision</u>: %RPD, % RSD (field duplicates; lab duplicates; check standards);
> <u>Accuracy</u>: Blanks, matrix spikes, post-digestion spikes;
> <u>Representativeness</u>: Ensure that samples are representative for area; appropriate and accepted analytical procedures are used; problems in investigation are properly documented;
> <u>Completeness</u>: Ensure all samples defined in plan are analyzed;
> <u>Comparability</u>: Use standard EPA analytical methods.

The project data objectives for precision, accuracy, completeness, representativeness and compatability, are consistent with guidelines established by the EPA Contract Lab Program.

C.3.1 QA/QC SAMPLES

Five percent of all samples will be split and analyzed at a second lab. The analysis comparisons will be made to ensure accurate and reproducible results are ascertained from each laboratory.

One decontamination rinsate sample will be collected for ten percent of all soil samples collected if non-disposable sampling implements are used.

C.3.2 ANALYTICAL METHODS

The soil samples will be analyzed for the constituents of concern according to EPA Methods. The soil samples and splits will be analyzed at two Certified Environmental Laboratories in Salt Lake City, Utah.

All analytical procedures will be consistent with federal guidance (US EPA 1986).

To assure precision, accuracy and completeness, the following steps will be taken:

a) All the samples will be dried (at 100°C to complete dryness) and 5% will be split at PPG and submitted to the laboratory as a "duplicate". Relative percent difference (RPD's) between the results of these two samples will be calculated and plotted.

b) The laboratory will be requested to provide "NIST/EPA STANDARDS" and analyzed for Ag, As, Ba, Cd, Cr, Hg, Pb, Se, Zn Cu, Fe and SO_4 and report the actual results. Analyzed parameters will be compared with the EPA's reported analysis. Upper Control Limits (UCL) and Lower Control Limits (LCL) will be calculated and graphed as per EPA's standard protocol.

c) The lab will also be asked to spike every tenth (10th) sample and report the spike recovery percent. The results will be graphed with the UCL and LCL's.

C.3.3 DATA REDUCTION, VALIDATION, AND REPORTING

All data will be reported in appropriate units. All raw data will be reviewed and validated against calibration records to ensure that data are reliable, and that data are in compliance with QA/QC objectives. Upon completion, a copy of the signed laboratory report will be submitted to the appropriate agency for review.

Raw data from field measurements and sample collection activities that are used in project reports will be appropriately identified.

QC records showing accumulated precision and accuracy data will be maintained in the laboratory and reported along with analytical results. Poor quality results require that the problem be determined and corrected.

C.3.4 LABORATORY PERFORMANCE AUDIT:

KUC/PPG will audit the Analytical Laboratories to ensure laboratory performance consistent with data quality and quality assurance objectives stated in the Kennecott QAPP and in the Work Plan for the Evaporation Ponds Site.

C.3.5 CORRECTIVE ACTION

If QC results detect conditions or data that do not meet QC requirements, corrective action will be initiated. The nature of the action will depend on the circumstances unique to each situation and may include:

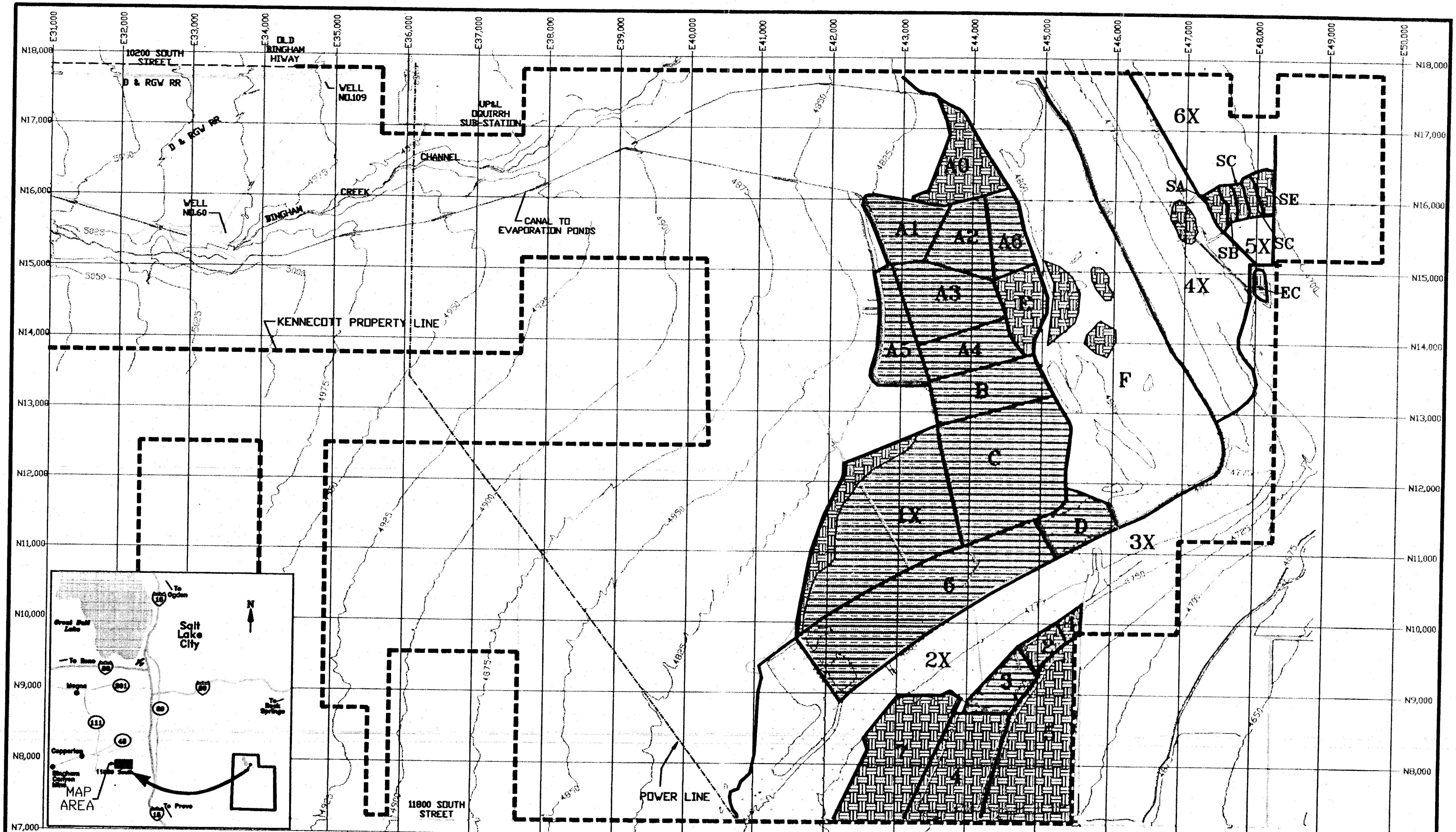
- Reanalyzing the samples, if holding time criteria permit;
- Resampling and analyzing;
- Evaluating and amending sampling and analytical procedures; and
- Accepting data, acknowledging level of uncertainty.

C.3.6 QA REPORTS TO MANAGEMENT

Final field and laboratory reports will be submitted to the QA/QC Officer for review; issues requiring clarification will then be addressed. Following review by the QA/QC Officer, final field and laboratory reports will be submitted to the Project Manager or client representative on a monthly basis and/or at the completion of individual projects.

Distribution: Documents will be distributed to the following:

External copies:	Three
Internal copies:	1 for Document Control Room 1 for File 1 for Project Director 1 for Project Manager 1 for Project QA Manager



NOTE

CONTOUR INTERVAL = 25'

TOPOGRAPHY DERIVED FROM 1990 PHOTOGRAPHY

KUC PROPERTY BOUNDARY

KUC EVAPORATION PONDS BOUNDARY

Impacted soils visible at surface -no vegetation

Iron stained soils -sparsely vegetated

Vegetated

GRAPHIC SCALE

PLANT PROJECTS GROUP

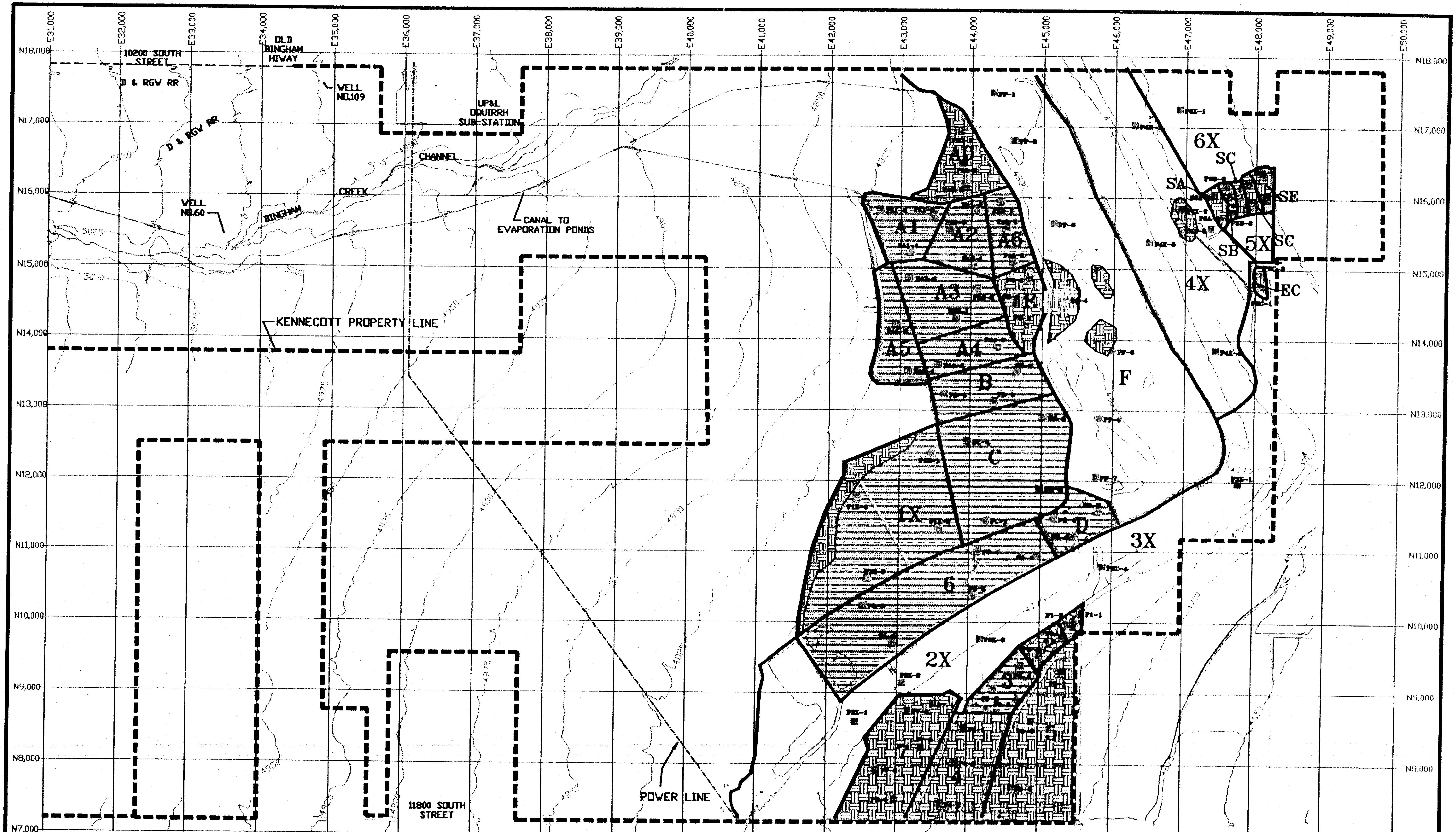
SCALE:

	JB	10/93
	JB	10/93

KENNECOTT UTAH COPPER

SOUTH JORDAN EVPORATION PONDS GENERAL SITE LOCATION MAP

Job No. JOB_NO | Dwg. No. 451-T-3504 | REV 0



NOTE

CONTOUR INTERVAL = 25'

TOPOGRAPHY DERIVED FROM 1990 PHOTOGRAPHY

KUC PROPERTY BOUNDARY

KUC EVAPORATION PONDS BOUNDARY

Proposed exploration trench

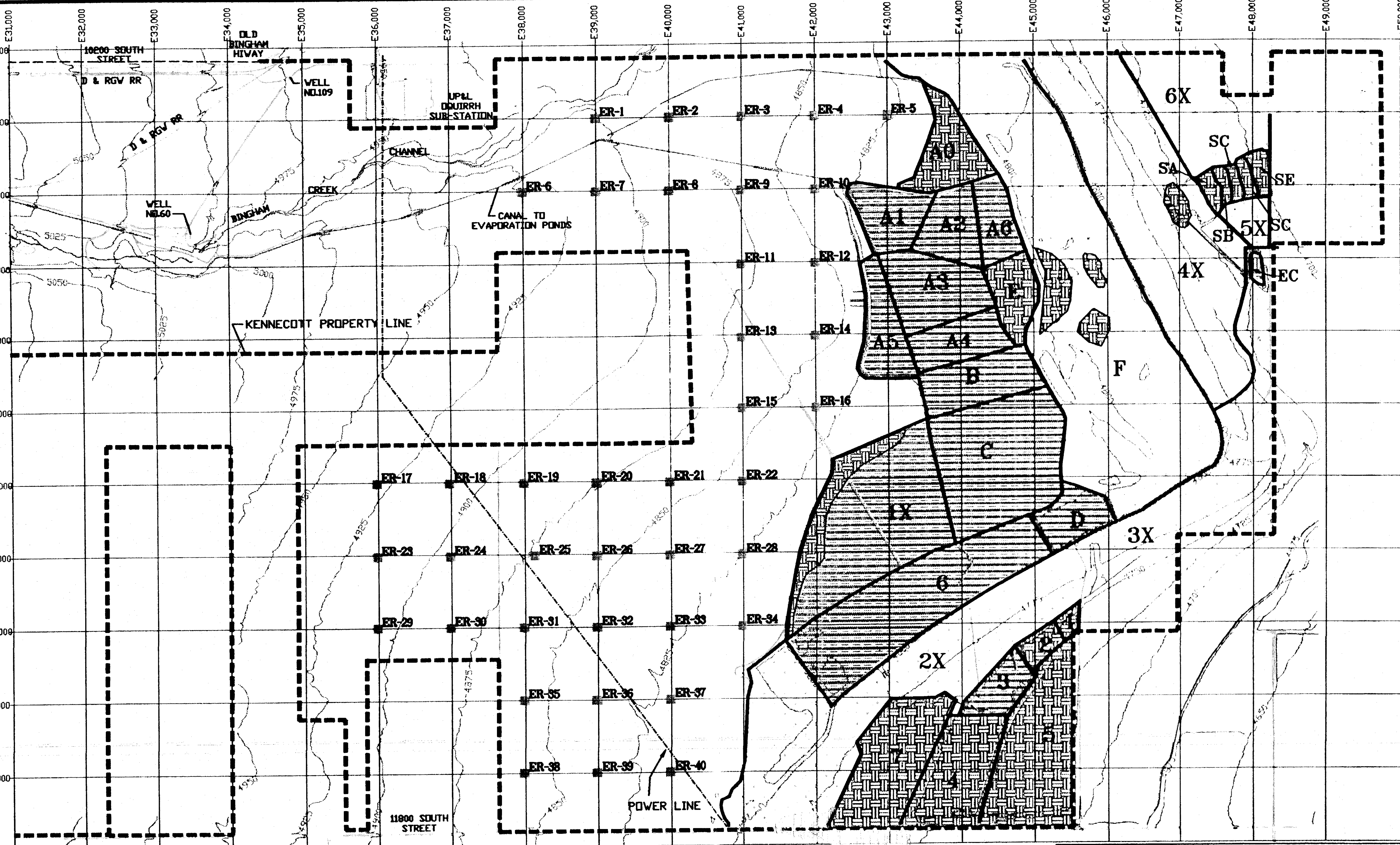
Impacted soils visible at surface -no vegetation

Iron stained soils -sparsely vegetated

Vegetated

GRAPHIC SCALE

PLANT PROJECTS GROUP			KENNECOTT UTAH COPPER
SCALE:			SOUTH JORDAN EVPORATION PONDS EXPLORATION TRENCH PLAN
	JB	10/93	
	JB	10/93	
			Job No. JOB_NO · Dwg. No. 451-T-3505 · REV 0



NOTE

CONTOUR INTERVAL = 25'

TOPOGRAPHY DERIVED FROM 1990 PHOTOGRAPHY

KUC PROPERTY BOUNDARY

KUC EVAPORATION PONDS BOUNDARY

Proposed resource evaluation trench

Impacted soils visible at surface -no vegetation

Iron stained soils -sparsely vegetated

Vegetated

GRAPHIC SCALE

(IN FEET)

PLANT PROJECTS GROUP			KENNECOTT UTAH COPPER
SCALE:			SOUTH JORDAN EVPORATION PONDS RECLAMATION MATERIALS EXPLORATION TRENCHES
	JB	10/93	
	JB	10/93	
			Job No. JOB_NO Dwg. No. 451-T-3506 REV 0

PROPOSED EXPLORATION TRENCHES

POND	TRENCHES	POND	TRENCHES
A-0	3	5	3
A-1	3	6	5
A-2	3	7	5
A-3	3	1X	4
A-4	2	2X	4
A-5	2	3X	1
A-6	3	4X	5
B	3	5X	0
C	4	6X	1
D	3	SA	2
E	3	SB	2
F	7	SC	2
1	2	SD	2
2	2	SE	2
3	3	SF	2
4	3		

TOTAL TRENCHES: ±89

- Proposed exploration trench
- Impacted soils visible at surface -no vegetation
- Iron stained soils -sparsely vegetated
- Vegetated

KUC PROPERTY BOUNDARY

KUC EVAPORATION PONDS BOUNDARY

GRAPHIC SCALE

(IN FEET)

NOTE

CONTOUR INTERVAL = 25'

TOPOGRAPHY DERIVED FROM 1990 PHOTOGRAPHY

PLANT PROJECTS GROUP			KENNECOTT UTAH COPPER
SCALE:			
	JB	10/93	SOUTH JORDAN EVPORATION PONDS EXPLORATION TRENCH IDENTIFICATION FOR SITE CHARACTERIZATION
	JB	10/93	
Job No. JOB_NO			Dwg. No. 451-T-3507 REV 0

CONSOLIDATION WORK PLAN

SOUTH JORDAN EVAPORATION PONDS

CONSOLIDATION ACTION WORK PLAN

KENNECOTT UTAH COPPER

BINGHAM CANYON, UTAH

SITE No.

Prepared and Submitted by:

Kennecott Plant Projects Group
Bingham Canyon, Utah

June 15, 1994

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1.0 INTRODUCTION

The South Jordan Evaporation Ponds Site is located seven miles east of the Bingham Canyon Mine, one mile south of Bingham Creek, five miles west of the Jordan River, and one mile west of the City of South Jordan (Dwg.No.451-T-3504). The South Jordan Evaporation Ponds (the Ponds) were used to store and evaporate Bingham Creek waters, including mine tailwaters, storm waters, and eroded sediments from Bingham Creek and ARCO's Tailings Ponds. The sediments currently in the Ponds include water deposited sand, silt, tailings, both treated (lime addition) and untreated sludge, and other material including cap or lining material. For the purposes of this Work Plan, sediments will include all material other than native soils underlying the Ponds and immediately adjacent areas as shown on Drawing No. 451-T-3505.

Kennecott and its contractors will be performing the excavation, transport, consolidation, and capping of the pond sediments. Consolidation procedures, soil sampling protocols, health and safety requirements, and air monitoring methodologies specified are consistent with those used during other actions conducted by KUC and at similar sites. The following Work Plan details the action that will be conducted during the 1994 and 1995 construction seasons.

1.1 Site Summary

The Site lies on a gravel bar along the shoreline of Late Pleistocene Lake Bonneville and is underlain at shallow depth by shoreline deposits and alluvial materials (Kennecott 1991). The Ponds were utilized as outlined above from 1936 until 1965. Following construction of the Large Bingham Reservoir in 1965, the Ponds were used on an emergency basis only to store and evaporate excess runoff from the Bingham Canyon watershed, although they continued to receive precipitation and local runoff from the Bingham Creek drainages below the Large Bingham Reservoir. Water from drainages above the Large Bingham Reservoir was discharged to the Site during the extreme wet periods of 1973-74, 1975-76, and 1983-84. Additional ponds were constructed in 1983 and 1984 and were utilized until 1986.

Dames & Moore (1988) estimated the discharge to the Evaporation Ponds in their synthesis of the Five-Year Hydrogeologic Study conducted by Kennecott in 1983-87. During the most recent periods of discharge to the Site, some of the waters were treated with lime before discharge. The Ponds have not been used for process water diversion since 1986.

In 1992, Kennecott built a desilting basin in Bingham Creek at the point of diversion for the Evaporation Pond Canal. The purpose of the desilting basin was to settle out contaminated material eroding from upgradient source areas to the Site. Sediments in the Ponds have formed a crust that appears to minimize blowing dust.

1.2 Site Investigation

The most recent and complete characterization activities for the South Jordan Evaporation Ponds Site were conducted by Kennecott to assess pond sediment and native soil conditions for design and evaluation of potential remediation actions (South Jordan Evaporation Ponds, Pond Sediment and Soil Investigation Report, Kennecott, 1994). Potential hazards to human health and the environment associated with the Site were evaluated to confirm they would be addressed by the selected action, i.e., consolidation and capping. Findings of the site investigation were compiled by Kennecott and submitted to the United States Environmental Protection Agency (USEPA) and Utah Department of Environmental Quality (UDEQ) on or about April 9, 1994.

General findings of the investigation revealed the Site consists of 25 distinct ponds definitions separated by earthen embankments and 7 areas adjacent to the Ponds (Adjacent Areas) that may have been affected by operations. The Ponds cover approximately 536.5 acres and Adjacent Areas cover approximately 619.5 acres (Dwg.No.451-T-3505). A detailed log of lithologic units mapped for each Pond and Adjacent Area can be found in Appendix G of the Investigation Report (Kennecott, 1994). The following are general descriptions of lithologies at the Site.

Pond Sediments:	Tan to light brown, fine grained material, silty sands/silty clays; pond water deposited sediments.
Treated Sludge:	Yellow, light brown to dark brown, fine grained material; silty clays/clayey silts deposited within the ponds by the impounded lime treated waters from 1983 through 1987.
Untreated Sludge:	Orange, fine grained material; silty clays/clayey silts deposited within the ponds by the impounded untreated waters from 1937 through 1983.
Clay Liner:	Brown to dark brown, strongly plastic silty clay, compacted in place.
Temporary Cap:	Brown to dark brown, sandy gravel. This material was introduced to serve as a dust suppressant in the early to mid 1970s.
Native Soils:	Late Pleistocene Bonneville sediments: silty sands, sandy gravels and clean gravels (with minor sand matrix).

Four ponds were identified that contained material placed over pond waste as a temporary cap. One pond was identified that contained a compacted soil and clay liner interval between the pond waste and native soil.

Lead and arsenic were the metals of primary concern identified during the Site investigation and are found in distinct, localized areas. In addition, elevated levels of sulfate were identified in Pond sediments and Adjacent Area native soils. However, infiltration calculations indicate that there will be no significant introduction of leachable sulfate to the ground water; the predicted value of sulfate concentrations as a result of leaching due to potential pond seepage is well below any level of concern for sulfate in drinking water.

Lead was chosen as the indicator metal consistent with removal actions for similar waste materials and due to the fact that when soils with elevated levels of lead are removed, other metal values have been reduced to acceptable levels. Sediments with lead concentrations above 2000 ppm will be considered "hot spots". Lead is a hazardous substance as defined by 101(14) of CERCLA. It is believed that the elevated levels of lead are the result of historic lead mining, beneficiation and extraction activities and downgradient transport of the resulting sediment. These deposits present a potential future health hazard to humans. To mitigate this potential health risk, Kennecott Utah Copper (KUC) will implement this Action for the affected area.

2.0 SCOPE OF ACTION

The work to be completed, governed by this Work Plan, includes 1) the excavation, removal, and placement of mine waste rock used to construct pond levees to Kennecott's Bingham Canyon mine waste rock disposal areas (Keystone Slot), 2) the excavation, removal and disposal of "hot spots" in Kennecott' Bluewater Repository, and 3) the excavation, transport, on-site consolidation and soil capping of the remaining pond sediments. The site boundaries are shown in Figure 451-T-3522. A vegetated soil cover (36") will be placed over the 250 acre (approximate) consolidation area. This Action will reduce contaminant exposure to the public, reduce both wind and water erosion of sediments, revegetate previously barren areas, and reduce the area of Kennecott property affected by these sediment deposits.

This Work Plan is sufficiently detailed to allow the lead agency to review and evaluate the consolidation action procedures. The Work Plan also provides essential field discretion for the on-site coordinators to adjust operations for site-specific circumstances, within the scope as defined above.

2.1 Action Objectives

The objective of this consolidation action is to incorporate the pond sediments into a single site, mitigating potential health risks to humans and increasing the overall environmental quality of the South Jordan Evaporation Pond Site. The objectives of the consolidation Action, based on soil characterization data from the Site, are as follows:

- Improve protection of human and ecological receptors from unacceptable risks due to ingestion of, or contact with potential chemicals of concern in pond sediments and surface soils;
- Remove waste rock with acid generating potential to Kennecott's Bingham Canyon Mine Waste Rock Disposal Area;
- Remove pond sediments with elevated levels of the indicator metal (lead) to an approved repository;
- Consolidate and cap remaining sediments in place;
- Improve protection of surface water, ground water, and air quality as a result of this consolidation action;
- Minimize land-disturbing activities wherever possible, both during and after this action.
- Maximize long-term use of the Site for recreational and other human use and reduce area which has been affected by pond sediments;
- Reduce the mobility of potentially hazardous substances by implementing this consolidation Action which is a technically feasible, permanent, and cost-effective remedy; and
- Minimize the effects of the consolidation Action on the public and environment.

2.2 Consolidation Criteria

Sediments from selected ponds (based on sediment quantity and sulfate concentrations) will be consolidated and physically stabilized in a footprint of approximately 250 acres. The consolidation area will include the entire or partial areas of ponds A1, A2, A3, A4, A6, B, C, D, E, 1X, and 6 (Dwg.No.451-T-3516). The consolidation area will be covered with 36 inches of clean soil and revegetated. Sediments containing elevated levels of lead (indicator metal) will be removed and placed in the Bluewater I Repository. Samples will be collected from material to be placed in Bluewater I following permit requirements. Pond A0 and A1 are the only ponds identified to date where elevated levels of the indicator metal exist. The material with elevated levels of lead in Pond A1 was identified between 7 and 8 feet below the surface.

This material will not be removed from Pond A1 due to the fact that the upper 7 feet of original material does not have elevated levels of lead present (<2000 ppm lead). In addition to the 7 feet of material, this portion of the Consolidation Area will receive 2 to 3 feet of compacted sludge and soil mix. The vegetative soil cover will then be placed over the Consolidation Area, resulting in an approximate total cover over the elevated lead soils of 12 to 14 feet of "clean" material. This type of cover material is consistent with and well over the required depth of 3 feet outlined in the Statement of Work from the Bingham Creek Channel, Phase 2 UAO. Material with elevated levels of lead from Pond AO will be removed and placed in the Bluewater I Repository as stated before.

Based on results from field investigations and similar removal actions conducted elsewhere, the pond sediment to be relocated will be removed on a visually guided basis and placed in the consolidation area. KUC will conduct post-removal sampling in the areas of excavation, as described in Appendix C, once an area is designated "clean". Post-removal samples will be analyzed for lead after excavation of sediments. The target clean-up level will be less than 2000 ppm lead soil concentration. Additional soils will be removed if the clean-up level is not achieved during the initial phase of removal. Sampling procedures and protocols described in Appendix C will be followed.

This consolidation Action includes removal of approximately 50,000 CY of mine waste rock that was used to construct pond levees. The waste rock will be relocated to the Kennecott waste dumps (the Keystone Slot specifically) within the leach collection system. Following removal of waste rock, "**surface** hot spots" and consolidation activities, the Site will be graded to control surface water and the removal areas (relocated pond sediment footprint locations) will receive a minimum 12" of clean soil and revegetated. Once all construction activities are complete, the Consolidated Area will be fenced.

2.3 Consolidation Procedures

The sediment and waste rock will be handled using appropriate excavation and transport equipment depending on the characteristics of the Site and material deposition.

Pilot scale trials have demonstrated that pond sediments in the consolidation area require surface preparation in order for construction equipment to access and work on the material. Approximately 400,000 CY of gravely borrow will be necessary for pond preparation prior to placement of additional pond sediments. Existing pond berm material may provide adequate quantities of preparation borrow. Approximately 480,000 CY of material **have** been identified in the existing berms. The physical quality and suitability of berm material as preparation material have been successfully evaluated and will continually be evaluated throughout the project. An alternate borrow source has been identified immediately west of the Evaporation Ponds on Kennecott property. Following preparation, roughly 1.6 million cubic yards of pond sediments will be placed in the consolidation area. The Ponds and Adjacent Areas containing sediment that will be removed and placed in the consolidation area are A-0, A-5, D (partial), 1X (partial), 6 (partial), 1, 2, 3, 4, 5, 7, F (partial), 4X (partial), SA, SB, SC, SD, SE, and EC (Dwg.No.451-T-3516).

Subsequent to placement of pond sediments in the consolidation area, the removal areas will be regraded and both the removal and the consolidation areas will be covered. Approximately 1.1 million cubic yards of replacement fill material and 0.3 million CY of topsoil will be required to adequately recontour removal areas. The three foot soil cover for the consolidation area will require approximately 1.9 million cubic yards of fill material and topsoil combined. A borrow source has been identified immediately west of the Ponds on Kennecott property for topsoil and fill materials.

2.3.1 Types of Equipment

Based on results from field investigations and execution of the pilot program, dozers, front-end loaders, excavators, and scrapers will all be appropriate for removing sediment from the Ponds. Characteristics of sediment vary for each pond and equipment that is effective in one pond may not be the most appropriate in the next. Smaller excavation equipment may be used in difficult access areas, if suitable. There are many different excavation methods that are anticipated and those ultimately employed will be the most practical and cost effective as determined in the pilot excavation activities and continued experience.

Other standard construction equipment will be employed to build and maintain haul roads and maintain a safe Site, as appropriate. Site specific conditions will likely allow more than one area of excavation to be managed concurrently. This opportunity will be evaluated and implemented if appropriate, once project activities commence.

2.3.2 Engineering Controls - Excavation and Loading Area

Engineering controls, such as water application before and during excavation and loading will ensure that both occupational exposures and airborne emissions from the work zone are below accepted levels for total suspended particulate (TSP), lead, and arsenic. The action levels for lead and arsenic are 30 ug/m^3 and 5 ug/m^3, respectively. The Permissible Exposure Limit (PEL) for TSP is 15,000 ug/m^3. Additional engineering controls will be employed based on air monitoring results as necessary.

Air samples will be collected and analyzed according to the Sampling and Analysis Plan included in Appendix A and the South End Study Area, Ambient Air Quality Monitoring Plan and Quality Assurance Plan (Envirocon, 1992).

2.4 Transport Procedures

Pond sediment will be hauled from loading areas to the consolidation area using appropriate haulage trucks and (or) scrapers. The size of equipment may vary due to space limitations and other site access requirements.

2.4.1 Types of Equipment

A broad, flat depositional environment, such as the Ponds, is one in which large transports (capacities of 15 to 20 CY) can maneuver and be directly loaded. Direct loading will increase efficiency and eliminate stockpiling material. Where access and feasibility are restricted, transports will be loaded at a designated loading zone and haul to the Keystone Slot or Bluewater I Repository. Due to the short haul distance on public roads and because of the physical nature of the material, it may not be necessary to tarp haul trucks. If visible release of contaminated airborne emissions is evident, haul trucks will be covered or tarped from the loading zone to the Keystone Slot or Bluewater I Repository.

2.4.2 Staging Area

The staging area for site operations will be located on Kennecott property near the intersection of 10200 South and 4000 West streets. The staging area will serve as a controlled zone for decontamination facilities, a general maintenance area, personnel parking, contractor office space, and fuel storage. The site will be accessed from this point by all employees and site visitors.

The staging areas will be decontaminated, if necessary, after operations are completed by removing the top two to four inches of soil. This soil will be hauled to and placed in the consolidation area prior to placement of the soil cover.

2.4.3 Haul Route

Excavated waste rock will be transported to the Keystone Slot using constructed haul roads at the Site to 11800 South; 11800 South to Utah Highway 111; and UH 111 to Kennecott Gate 44 haul road which leads directly to the Keystone Slot. Excavated pond sediment, if any, will be transported to the Repository using constructed haul roads at the Site to 11800 South; 11800 South to Utah Highway 111; and (or) up the South Bingham Creek haul road directly to UH 111 to Kennecott Gate 47 haul road which leads to the Bluewater I Repository. Haul routes may require adjustment to address site-specific conditions.

2.4.4 Decontamination Procedures

Haul trucks leaving the work zone will be inspected prior to entry on haul roads. Work crews will be responsible for physically removing soil deposits or spillage collected on the vehicle. Other machinery will be decontaminated upon completion of project specific activities. Decontamination equipment will be maintained in the staging area, as needed. Soils from decontamination procedures will remain or be placed in the consolidation area.

Haul roads will be decontaminated as needed. A visual inspection of the haul roads will be conducted prior to cessation of the work activities. Decontamination will consist of removing any material that may have spilled enroute. This material will be disposed in the consolidation area or the Bluewater Repository depending on the lead concentration.

2.4.5 Engineering Controls

During excavation, loading, transportation, and dumping operations, engineering controls such as water application will be implemented as appropriate. These controls will ensure that occupational exposures and airborne emissions are below acceptable levels for the contaminants of concern and total airborne dust.

2.4.6 Emergency Spill Contingency Plan

Any accidental spills of mine waste rock or sediments that might occur during transportation will be responded to by Kennecott. The following measures will be implemented:

- All truck transports will be equipped with radios to notify the project coordinators in the event of an accidental spill.

- All truck transports carrying waste rock will be equipped with secured gates to reduce the possibility of an accidental spill.

- Appropriate equipment will be available from the Site to respond to any emergency spill situations.

3.0 RECONTOURING AND REVEGETATION

Prior to project activities, photos will be taken to document existing Pond contours and a pre-project survey will be conducted by recording critical elevations. These data will be used to establish final contouring throughout the Site, where pertinent. A perimeter drainage system will be installed to protect and control surface water adjacent to the consolidation area.

- A local borrow source has been identified immediately west of the Ponds. Following removal of all borrow material the resultings depression will be used to impound run-off. Any outflow will be diverted to Bingham Creek Channel or to the Water Control Ditch along 11800 South.

3.1 Local Borrow Fill

Local borrow fill will be used when possible for both recontouring the removal areas and to supply material for physically stabilizing and covering the consolidation area. Borrow material will be placed to blend into existing areas that were not affected. New slopes will be constructed with swales and undulations to obtain a more natural appearance. In areas where farming fields will be established, recontouring to obtain slopes of approximately 1 percent will be constructed towards existing drainages or fields to facilitate irrigation.

3.2 Erosion Control Methods

A variety of techniques will be employed to minimize erosion of the consolidation area and adjacent borrow areas and to reduce downgradient transport of soils. Temporary controls used for stabilization until the establishment of vegetation may include:

- Construction of shallow basins in adjacent borrow areas to intercept and store runoff inflow to the Site. These basins will also function as desilting basins. The basins will contain runoff from most light precipitation events with no inflow into the Site. Overflow from a basin will be conveyed through gradual swales to the controlling drainage.

- Contouring and shaping will be conducted at the top of new slopes and undisturbed slopes to limit inflow of runoff down the slopes. Runoff will be conveyed to basins, as described above, or directly into swales and drainages, if necessary.

- Shallow swales will be constructed in drainage bottoms to function as silt traps. These swales will retard soil transport downgradient until the establishment of vegetation. The swales will eventually fill with sediment.

- Scarifying of all new slopes on the consolidation area, modified slopes where possible, and all borrow areas will be conducted to depths of 6 to 16 inches, perpendicular to the slope. This will reduce runoff down the slopes and will improve infiltration, thus minimizing erosion.

3.3 Topsoil and Subsoil

Suitable topsoil and subsoil will be salvaged from existing berms prior to reclamation. As reclamation is completed, subsoil and/or topsoil will be replaced on borrow areas, removal zones, and the consolidation area. All areas will be scarified to depths of six to sixteen inches, followed by discing to a depth of six to eight inches to prepare the ground for seeding.

3.4 Fertilizing and Seeding

All areas disturbed as a result of project activities and the consolidation area will be fertilized and seeded except for those areas to be returned to farming. All areas to be seeded by Kennecott will be fertilized at a rate to provide 40 pounds of available nitrogen per acre with a 28N: 13P: 13K blend of commercial, granular fertilizer. Seed will be applied by drill or pit seeding at a rate of 30 pounds of pure live seed (PLS) per acre.

Drill or pit seeding techniques will be used because they provide improved germination and vegetation success compared to other seeding methods. Pit seeding provides effective soil erosion mitigation and conserves water. Miscellaneous areas inaccessible to equipment will be broadcast-seeded and hand-raked to lightly cover the seed with soil.

The following seed mixture will be used for areas to be revegetated by Kennecott.

Species	Lbs. PLS/Acre
Western Wheatgrass	6.0
Thickspike Wheatgrass	6.0
Slender Wheatgrass	6.0
Streambank Wheatgrass	6.0
Palmer Penstemon	0.3
Rocky Mtn. Penstemon	0.5
California Poppy	2.2
Blanket Flower	0.5
Lewis Blue Flax	2.2
Munro Globe Mallow	0.3
TOTAL	30.0

4.0 PERSONAL PROTECTION

Level D personal protective equipment (basic OSHA construction safety equipment) will be appropriate for all workers engaged in excavation, transportation, consolidation and recontouring activities. Personal protective equipment will be upgraded from Level D if necessary, based on results from air monitoring. A site-specific Health and Safety Plan (Appendix B) is included with this Work Plan and is based on available information from all investigative activities completed to date.

5.0 BLUEWATER I REPOSITORY

The Bluewater I Repository is located south of Copperton, Utah in the NE1/4 of the SE1/4 Section 18.T.3S,R.2W. The Repository is located in the Bluewater I drainage basin between two ridge tops within a natural draw. It occupies an area of approximately 43 acres, all contained within Kennecott's present leach collection system. A dirt haul road off of Utah Highway 111 provides access to the repository.

5.1 Description

The repository will receive pond sediment with associated overexcavation. Approximately 1.0 million CY of tailings and associated soils were previously placed in the repository. The repository consists of a clay bottom lining with a seepage collection system and previously placed contaminated soils. A composite low permeability clay barrier and soil cap will be constructed once placement activities are complete for a particular cell.

The pond sediment will be placed, graded, and compacted in 6" lifts to a minimum of 95 **percent** compaction (modified proctor) into the repository.

5.2 Air Monitoring

Air monitoring at the repository will be conducted by Kennecott to assess levels of airborne arsenic, lead, and TSP. Quantitative air monitoring will be conducted to document repository personnel exposure levels using appropriate monitoring equipment.

Samples of ambient air at the perimeter of work zones will occasionally be collected during repository work activities.

5.3 Decontamination Procedures

See Section 2.4.4.

5.4 Engineering Controls

See Sections 2.3.2 and 2.4.5.

5.5 Emergency Spill Contingency Plan

See Section 2.4.6.

5.6 Personal Protection

See Section 4.0.

5.7 Operations and Maintenance

After the pond sediments have been placed and the repository has been capped, the repository will be monitored as described below on a quarterly basis.

The seepage collection system and surface water diversion system will be inspected each quarter. The systems will be cleaned and maintained to provide continuity of their integrity. The repository cap will be inspected for structural defects on the same frequency. Vegetation will be observed at each inspection and repaired or maintained as necessary. If liquid is detected in the seepage collection sump during quarterly inspection, it will be sampled and analyzed for total lead and total arsenic. Sampling and analytical procedures will follow EPA guidelines. If contaminated seepage from the seepage collection system is confirmed, inspection will be increased to a once per week frequency. If flow subsides, the inspection frequency will correspondingly be reduced to quarterly. If flow continues to indicate a problem, a plan for corrective measures will be developed.

6.0 DOCUMENT ORGANIZATION

This consolidation action Work Plan is composed of the previous text and following appendices:

- Personnel and Work Zone Air Monitoring Plan (Appendix A);
- Site Specific Health and Safety Plan (Appendix B); and
- Soil Sampling and Analysis Plan including the Quality Assurance Project Plan (Appendix C).

7.0 SCHEDULE

The following outlines the schedule for major tasks and deliverables.

ACTIVITY OR MILESTONE	DATE COMPLETE
Pilot Scale Investigations	March 14, through May 30, 1994
Site Characterization Report with all investigative findings	April 9, 1994 (Submitted)
Work Plan	June 15, 1994
Waste Rock Removal	August 31, 1994
Tailings and Hot Spot Removal Ditches and Pond AO	End of 1994
Complete consolidation of pond sediments	End of 1994
Completion of Cap on Consolidated Area	End of 1995
Completion of Soil Cover for Removal Areas	End of 1995
Site Clean-up and Revegetation	July 1, 1996
Final Report	60 Days After Project Completion

8.0 REFERENCES

Dames & Moore, 1988, Milestone Report I, Data Base Synthesis: Contractor Report to Kennecott Utah Copper, Salt Lake City Utah, May, 64 p.

Kennecott, 1991, Environmental Action Project Plans: Report to U.S. EPA, Region VIII, Kennecott Corporation, June.

Envirocon, 1992, South End Study Area, Ambient Air Quality Monitoring Plan and Quality Assurance Plan, September.

Kennecott, 1994, South Jordan Evaporation Ponds, Pond Sediment and Soil Investigation Report, April.

APPENDIX A

PERSONNEL AND WORK ZONE AIR MONITORING AND ANALYSIS PLAN

A.1.0 INTRODUCTION

Kennecott Utah Copper will be conducting a consolidation action at the South Jordan Evaporation Ponds during the 1994 and 1995 construction seasons. This air monitoring plan will be part of the site-specific work plan and presents the methodology to be used by Kennecott for conducting personnel and work zone air sampling. If additional site-specific air monitoring information is required for a particular project or specific work tasks, an addendum will be attached to this plan. The South End Study Area, Ambient Air Quality Monitoring Plan and Quality Assurance Plan (Envirocon, 1992) will continue to be adhered to during this consolidation action. Additional ambient air monitoring locations will be installed if necessary.

Air monitoring samples will be collected to monitor for airborne emissions during the consolidation action. The sampling frequency will be based on the initial analytical results. The sampling will be conducted using high-flow battery powered personnel sampling pumps and high-volume ambient air pumps. Both of these pumps draw air through sampling media that is analyzed for the constituents of concern. The constituents of concern for this Site are lead, arsenic, and total suspended particulates. The quantitative air sampling will be used to monitor employee exposures and work zone boundaries. Miniature real-time aerosol monitors (Miniram) may be used when immediate results are needed for respirable dust.

The purpose of air monitoring is threefold:

- Document employee exposure, if any;
- Document potential work-zone particulate emissions; and
- Evaluate the effectiveness of dust control methods.

A.1.1 Background Air Sampling Procedures

Background air samples will be collected prior to any site activities. Previously collected data may serve as background data. The availability and useability of historical background data will be evaluated on a case-by-case basis. High-flow (2.0 L/min) and/or high-volume (20.0 L/min) samples will be collected at the site if necessary. The background samples will be used to determine a suitable reference data base for comparison with airborne particulate and metal concentrations measured during the project.

A.1.2 Personal Air Sampling Procedures

Personal monitoring will be performed with high-flow personal battery powered sampling pumps drawing air through sampling media following National Institute for Occupational Safety and Health (NIOSH) methodologies. The number of personal samples collected will be based on NIOSH recommendations and good industrial hygiene practice. Sampling procedures may be altered at the discretion of field sampling personnel as site-specific conditions warrant. NIOSH sampling results are quantitative and will be used to document site air quality and potential worker exposures during Site operations. MINIRAM monitors may be used to qualitatively measure personnel exposures.

A.1.3 Work Zone Sampling Procedures

Air samples will be collected at the work zones to determine particulate emission concentrations and document work zone air quality. The samples will be collected with both high-flow and high-volume (if necessary) sampling pumps drawing air through sampling media following National Institute for Occupational Safety and Health (NIOSH) methodologies. Sampling procedures may be altered at the discretion of field sampling personnel as site-specific conditions warrant. MINIRAM monitors may be used to qualitatively measure work zone and perimeter emissions.

A.2.0 AIR SAMPLING PROCEDURE

The following standard operating procedure (SOP) will be followed for all quantitative sampling conducted.

A.2.1 Air Sampling Sequence

The following procedures will be followed for all collected air samples.

1. Fill out logbook header at the beginning of the day;
2. Calibrate sampling pumps;
3. Connect filter cassette to pump, remove the inlet plug from filter cassette and turn on pump;
4. Document initial information about the individual samples and conditions in a field logbook, including calibrations, start times, locations and a map or diagram; and

5. Ensure required quality assurance field blank (1 per 10 samples) is opened and placed near a sampling pump (field blank) or a trip blank is carried during sampling routine.

At days end:

6. Turn off pumps, record stop time in field log, and plug cassettes;

7. Recalibrate pumps and record information in both the field logbook and the calibration documentation forms;

8. Place the pumps on charge overnight;

9. Prepare chain of custody forms for all samples; and

10. Either securely store or, package and ship samples, including chain of custodies.

Sequence events are described in detail in the following sections.

A.2.2 Logbook Header

An up-to-date sampling field notebook will be maintained by project personnel during all sampling activities. The general information recorded for each day's sampling includes:

- Date;
- Name of overall sampling event;
- Sampling personnel;
- Climatic conditions; and
- Equipment location and operating times.

Any other pertinent information will be recorded in the field notebook.

A.2.3 Pump Calibration

Air pumps will be calibrated on a quarterly basis using a graduated buret and a soap solution or daily with a BIOS International primary standard. With the first method, the pump is hooked up to an inverted buret, air is drawn through the open mouth of the buret, and a soap bubble is formed with a soap solution across the buret mouth. As the bubble is drawn up the buret across two pre-determined graduations, a stopwatch is used to record the elapsed time. From the graduated volume and elapsed time, the volume per time, or flow rate, can be calculated. The pump flow rate can then be adjusted as desired. Enter this calibration data on a calibration form as documentation.

Daily pump calibrations will be conducted using the BIOS primary standard or a secondary calibration device such as a rotometer. The rotometer must be calibrated against a primary standard. A calibration curve is then developed between the two standards.

A.2.4 Logbook Sample Entries

Quality assurance and quality control (QA/QC) procedures for air sampling require completion of a sampling log. For each sample collected (including blanks), the field sample logbook and office logs must contain:

- Sample number;
- Sampling location;
- Start and stop calibrated air flows;
- Average air flow;
- Start and stop time;
- Sampled volume;
- Sampling method (i.e. NIOSH);
- Field observations; and
- A map or diagram.

Significant deviations from sampling protocol shall be formally noted in the field log, along with visiting personnel and any unusual circumstances which might affect the sampling.

A.2.5 QC Blanks

One QC blank should be submitted with each 10 samples (10%). The blanks are unsampled cassettes that are returned to the lab with the other samples as a test for contamination during sampling and transport. Quality control procedures are outlined in following sections.

A.2.6 Cassette Label

To prevent sample misidentification, each sample cassette is affixed with a label. The following information will be recorded on the sample container:

- Date sample collected;
- Sampling pump identification number;
- Sample cassette number; and
- Chain-of-custody number.

A.2.7 Chain of Custody

To establish the documentation necessary to trace sample possession from the time of collection, a chain-of-custody record will be filled out for each sample and accompany every set of samples. The record will include the following:

- The project number;
- Air sample analysis request;
- Sample number;
- Flow rate;
- Length of sampling time;
- Signature of the collector;
- Sample date;
- Signature of person(s) involved in the chain of possession; and
- Time(s) and date(s) of change(s) of possession.

A.2.8 Sample Packaging and Shipping

Samples will be packaged in clean areas that are remote from potential contaminant sources. Packing material will be used to stabilize the cassettes during shipment, if necessary. Samples will be picked up, delivered or shipped for analysis once a sufficient amount of cassettes have been collected.

A.2.9 Analytical Methods

The air samples collected using NIOSH methods will generally be analyzed for lead and arsenic, and total airborne dust (see Appendix B, section 3.2). Other sampling upon request may include silica, asbestos, other metals, or any other constituent of concern. Samples will be analyzed using NIOSH standard methods. Samples for total airborne dust will be collected using cassettes containing pre-weighed filters, and will be analyzed gravimetrically.

A.3.0 QUALITY ASSURANCE AND QUALITY CONTROL

The purpose of data quality assessment is to confirm that data generated during the QA program is accurate and consistent with program objectives. The quality of the data will be assessed based on accuracy and completeness. Accuracy is a determination of how close the measurement is to the true value and will be assessed by laboratory calibration checks and cleanliness of blanks. Completeness is a measure of the amount of valid data obtained, compared to the amount that was expected under normal conditions. Ninety (90%) percent completeness is the goal of Kennecott air monitoring. The project data objectives for accuracy and completeness are consistent with guidelines established by NIOSH and OSHA.

A.3.1 Sampling Calibrations

Personal sampling pump flow will be calibrated following NIOSH protocol. The pumps will be calibrated at the beginning and end of sampling each day. The cassette used for pre-calibration will also be used for post-calibration. The two calibrations must be within 20% of each other or the day's sampling for that pump will be invalidated.

A.3.2 QC Samples

Internal quality-control checks will be conducted to evaluate the quality of data based on field conditions and constraints. The field QA/QC program will be conducted in addition to laboratory QA/QC. The following quality-control checks will be performed:

- Field Blank - Opened but unsampled filter cassette placed near an active sampler. The cassette is closed and returned to the lab with the other samples as a test for contamination during sampling and transport.

- Trip Blank - Unopened cassette that is subject to the same handling as sampled cassettes. The trip blank is returned to the lab as a test for contamination during handling and/or prior to receiving the cassette from the lab.

The above internal QC samples will be evaluated to determine if the field and transport procedures are adequate to provide valid analytical data. One field blank or trip blank will be collected and analyzed for each 10 samples. The evaluation process for data from QC samples is outlined below.

A.3.3 Data Reduction, Validation and Reporting

All data will be reported in appropriate units. All raw data will be reviewed and validated against calibration records to ensure that data are reliable and that the data are in compliance with QA/QC objectives. Upon completion, a copy of the signed laboratory report will be retained for future reference. Raw data from field measurements and sample collection activities that are used in project reports will be appropriately identified.

QC records, showing accumulated precision and accuracy data, will be maintained in the laboratory and reported along with analytical results. Poor quality results require that the problem be determined and corrected in a timely manner.

A.3.4 Corrective Measures

If QC system or performance audits detect conditions or data that do not meet QC requirements, corrective action will be initiated. The nature of the action will depend on the circumstances of each situation and may include:

- Evaluating and amending sampling and analytical procedures; and
- Accepting data, acknowledging level of uncertainty.

Any corrective measures taken during the monitoring program will be described in the monthly and final reports.

A.3.5 QA Reports to Management

Final field and laboratory reports will be submitted to the QA/QC Officer for review; issues requiring clarification will then be addressed. Following review by the QA/QC Officer, final field and laboratory reports will be submitted to the Project Manager on a monthly basis and at the completion of individual projects. The reports will include the following:

- Total number of samples collected for the month/project;
- Total number of samples voided for the month\project;
- Total number of blanks for the month/project;
- Percent blanks and percent complete for the month/project;
- Number of days lost due to weather or other unforeseen circumstances; and
- Text description of project activities.

APPENDIX B

SITE SPECIFIC HEALTH AND SAFETY PLAN

B.1.0 INTRODUCTION

This Health and Safety Plan (HASP) applies to activities related to Kennecott and the consolidation action at the South Jordan Evaporation Ponds Site. The work will be conducted by employees, contractors, and subcontractors of Kennecott. This Health and Safety plan will be available at all times at the work area for review by employees, contractors, subcontractors, regulatory agencies, or representatives thereof. All visitors and regulatory personnel are expected to be familiar with and comply with all aspects of this Health and Safety Plan.

This HASP is designed to identify, evaluate, and control health and safety hazards associated at the South Jordan Evaporation Ponds. The plan is based upon existing information regarding the entire site (properties east of Bingham Pit), similar work conducted to date on Kennecott property, and past experience at other sites. Addressed are specific safety and health hazards and procedures necessary to protect the employees conducting the various project activities. If an individual task has a health and safety issue or circumstance that is not addressed in this plan, an addendum will be provided when the issue is identified.

In the event site conditions change, sections of the HASP may also change, and will then be subject to approval by the Health and Safety Officer (HSO). Any changes will be communicated to all employees.

B.2.0 COMPREHENSIVE WORK PLAN

A comprehensive Sampling and Analysis Plan (SAP) for the operations to be conducted follows this HASP. The Work Plan and SAP describe the work tasks, objectives, personnel requirements, and methods for conducting investigation activities.

B.3.0 JOB HAZARD ANALYSIS

The potential hazards associated with site activities include both chemical and physical hazards. Equipment operators and laborers directly involved in day-to-day project activities have the greatest potential for exposure to these hazards. Site scientists and supervisors generally have lower potential exposure to these hazards.

If judged by the Health and Safety Officer (HSO) to be necessary, a Job Hazard Analysis will be performed at the HSO's direction. General categories of potential hazards may include those listed in this section.

B.3.1 Physical Hazards

This section describes normal physical construction site hazards.

B.3.1.1 Heat Exhaustion

Heat exhaustion occurs when the body loses so much water and electrolytes through very heavy perspiration that fluid depletion (hypovolemia) occurs. For sweating to be an effective cooling mechanism, the sweat must be able to evaporate from the body surface. If evaporation does not take place, cooling will not occur. Heat exhaustion is a potential hazard associated with elevated body temperatures caused by high ambient air temperatures and high humidity, heavy physical labor, wearing personal protective equipment, and/or any combination thereof. This hazard will be evaluated on a day-to-day basis by the Construction Superintendent and Health and Safety Officer.

B.3.1.2 Cold Exposure

Cold injury (frostbite and hypothermia) and impaired work ability are potential hazards at low ambient air temperatures and/or when the wind chill factor is high. The symptoms associated with cold exposure are excessive shivering, loss of control of muscle activity, lethargy and loss of interest in combatting cold, and finally, decreased vital signs. This hazard will be evaluated on a day-to-day basis.

B.3.1.3 Inclement Weather

Rain, snow, extreme low or high temperatures, or high winds may occur during scheduled work activities. All employees will be trained in the hazards of exposure to cold and/or wet conditions. Protective clothing for cold and/or wet, slippery conditions will be used when needed. Severe weather conditions may result in cessation of work activities at the discretion of the Project Manager, Construction Superintendent or Health and Safety Officer.

B.3.1.4 Utility Lines

Overhead utility lines are present near the work area but should not pose a hazard. All operators and ground personnel should always be aware of all overhead hazards and warn each other of potential danger. All underground utilities will be located and clearly marked prior to excavation. A close proximity permit from Kennecott will be obtained when any large piece of equipment must operate within 10 feet of an energized line.

B.3.1.5 Noise

Exposure to elevated noise is expected for heavy-equipment operators and, potentially, some ground personnel. This hazard will be controlled by wearing the appropriate level of hearing protection. Either ear plugs or earmuffs will be encouraged for heavy-equipment operators, laborers, and any other personnel working near the equipment. The Health and Safety Officer will assist in determining the proper level of hearing protection to be worn by site personnel.

B.3.1.6 Construction

As on all construction sites, there is potential for personal injury. American National Standards Institute (ANSI) approved equipment will be required. Hard hats, steel toe boots, and safety glasses will be required to guard against head, foot, and eye injuries. All required construction equipment will have appropriate audible or visual warning alarms. Applicable MSHA and OSHA regulations will be followed and enforced.

The excavation standard outlined in 29 CFR 1926 will be adhered to at all times. A competent person shall inspect all excavations that personnel must enter to ensure proper sloping has been achieved. The competent person will determine if shoring is required and will work with the Kennecott HSO on implementing appropriate shoring techniques. An excavation permit must be obtained and signed by the HSO.

B.3.1.7 Dust Suppression

Dust may be generated during excavation, transportation and placement of material. Water spray, tarping of transport vehicles, or other controls will be used, as necessary, to control dust levels. Air monitoring will be conducted to ensure that occupational exposures to emissions from work areas are below accepted safe levels.

The OSHA time-weighted average (TWA) for silica (SiO_2) is 0.05 milligrams per cubic meter (29 CFR 1910.1000). The OSHA Permissible Exposure Limit (PEL) for total suspended particulate (TSP) is 15,000 micrograms per cubic meter in air for any 8-hour time-weighted average (29 CFR 1910.1000).

B.3.1.8 Other Physical Hazards

Other physical hazards such as insect bites, stings, etc. may occur during investigation operations. Precautions will be taken to prevent these hazards.

B.3.2 Chemical Hazards

Based on available information regarding the site, metals of concern identified in the pond deposits are arsenic and lead. Other metals are present but arsenic and lead have been selected as hazard indicators due to their low action levels (AL) and PELs. If additional chemical hazards become evident, such as silica or other metals, appropriate measures will be taken to monitor and protect the health and safety of personnel on the site and prevent off-site migration. All employees will be notified of any new hazards as they become known.

B.3.2.1 Arsenic

Arsenic is a solid material with no odor. Potential exposure routes are through inhalation or ingestion. Skin contact can also result in adverse effects. Some arsenic compounds may cause irritation of the eyes, mucous membranes, respiratory system, and skin. Dermatitis can also result from poor personal hygiene when working around these materials. Excessive inhalation of arsenic may result in respiratory problems such as coughing and chest pain. Other symptoms include giddiness, headache, and extreme weakness preceding gastrointestinal irregularities. Prolonged exposure can result in weight loss, nausea, diarrhea, pigmentation of skin, and loss of hair. Arsenic is considered a carcinogen; a cancer-causing substance.

The OSHA AL for arsenic is 5.0 micrograms per cubic meter in air for an 8-hour time-weighted average (29 CFR 1910.1018). The OSHA PEL for arsenic is 10 micrograms per cubic meter in air for an 8-hour time-weighted average.

B.3.2.2 Lead

Lead is a solid material with no odor. Potential exposure routes are through inhalation or ingestion. The early effects of overexposure to lead are nonspecific and are difficult to distinguish from the symptoms of minor seasonal illnesses, except by laboratory testing. The symptoms are decreased physical fitness, fatigue, sleep disturbance, headache, aching bones and muscles, abdominal pains, and decreased appetite. More advanced effects include anemia, pallor, a "lead Line" on the gums, and decreased hand grip strength. Lead colic produces intense abdominal pain with nausea and vomiting. Headache, convulsions, coma, delirium, and kidney damage can occur. Lead is not considered a carcinogen but it is classified as a reproductive toxin and a teratogen (fetal malformation).

The OSHA AL for lead is 30 micrograms per cubic meter in air for an 8-hour time-weighted average (29 CFR 1910.1025). The OSHA PEL for inorganic lead is 50 micrograms per cubic meter in air for an 8-hour time weighted average.

B.3.3 Hazard Mitigation

The hazards identified in the above sections, and any additional hazards which arise or are identified during work activities will be mitigated by personal protective equipment (PPE), engineering controls, and other safety procedures. Physical hazards will be mitigated by the implementation and enforcement of standard operating procedures described in Section 9.0. Chemical hazards will be identified through the air monitoring program described in Section 7.0 and mitigated by the use of PPE, engineering and site controls.

B.4.0 PERSONAL PROTECTIVE EQUIPMENT

Occupational exposures to arsenic, lead, and TSP are expected to be well below action levels specified in CFR 1910.1018, 1025, and 1000, respectively. Therefore, the level of personal protection to be utilized for all initial site activities is Level D. Level D personal protective equipment (PPE) shall consist of a hard hat (ANSI Z89), safety glasses (ANSI Z87), steel-toed boots (ANSI Z41 with substantial leather 6-inch uppers) and cotton coveralls. Gloves and hearing protection may be required for task specific work. Work zone visitors will be required to wear applicable safety equipment depending on the duration and extent of involvement at the site. The level of protection will be adjusted according to results of employee exposure monitoring, specific job functions, or as site conditions change.

B.5.0 TRAINING REQUIREMENTS

The Kennecott Health and Safety Officer will be responsible for **determining** which oversight agency , MSHA or OSHA, has jurisdiction for each project. There may be instances where both agencies will have enforcement jurisdiction.

All employees and supervisors working in excavation of contaminated materials will be required to have 40 hours of hazardous substance training. These employees will receive a minimum of 24 hours of on-the-job-training. Copies of training certificates and other training documentation will be submitted to the Kennecott Safety Officer and will also be kept on file near the job site.

Project employees performing work that is subject to MSHA regulations, will receive Newly Employed Experienced Miner Training, as defined by MSHA regulations. These employees will be required to demonstrate that they have job related experience. If employees do not have job-related experience, they will be required to receive New Miner Training, as defined in MSHA regulations. These project employees not subject to MSHA, will be required to receive all new-hire orientation training as specified in the OSHA regulations.

All employees and supervisors working in the excavation of contaminated material will be required to have 40-hours of hazardous substance training. Certificates and training documentation should be kept near the job site.

Employees will be trained to a level required by their job function and responsibility before being permitted to engage in field activities. Pre-employment safety information will include:

- Names of personnel and alternates responsible for site safety and health;
- Chemical and physical hazards present on the site;
- Work practices by which risks from hazards can be minimized;
- Detailed review of this HASP and Kennecott Emergency Protocols;
- Safe use of engineering controls and equipment on the site;
- Use of personal protective equipment; and
- Medical surveillance requirements, including recognition of symptoms and signs which might indicate overexposure to hazards.

Site safety meetings (tailgate meetings) will be held at least weekly to notify personnel of specific hazards, air monitoring results, changes in the HASP, or other topics determined by the Health and Safety Officer and Construction Superintendent. Specific meetings will be held at the initiation of new or different field activities and at the time of any crew changes. Kennecott will conduct weekly supervisor planning/safety meetings.

B.6.0 DECONTAMINATION PROCEDURES

Equipment decontamination will be conducted on site as appropriate. Equipment decontamination will consist of physically removing visible contamination from contact points of the equipment at completion of work tasks and before leaving the work area. The removed material will remain in the work zone. Equipment can be decontaminated at the Kennecott decontamination station if it is close enough to work activities or can be transported to the station without contaminating roads.

Personal decontamination will consist of removing and leaving outer PPE at the work zone or safety trailer and good personal hygiene. Employees will be required to wash with soap and water at each break, lunch period and at the end of the work shift. Facilities for employee decontamination will be provided on-site.

Decontamination procedures will be monitored by the Health and Safety Officer to determine their effectiveness. If such procedures are found to be ineffective, they will be altered to correct any deficiencies.

B.7.0 AIR MONITORING

Air monitoring will be conducted to evaluate the potential for employee exposure to airborne contaminants and to determine the overall contribution of work activities to ambient air quality, as specified in the Air Monitoring Plan, Appendix A. Prior to any activities on site, background air samples will be collected to establish a datum for site activities. During excavation and placement activities, quantitative and potentially qualitative air sampling will be conducted to determine employee exposures.

All air samples will be collected and analyzed according to the appropriate National Institute of Occupational Safety and Health (NIOSH) method for determining concentrations of arsenic, lead, and TSP (see Appendix A).

B.7.1 Occupational Air Monitoring

Quantitative personal samples will be collected using constant-flow pumps that draw between 1.0 and 2.0 liters of air per minute or as specified in the Air Monitoring Plan. The samples will be handled under chain-of-custody procedures and delivered to a qualified laboratory for analysis (See Appendix A).

Employees with the highest potential for exposure will be selected for personal monitoring. At the start of field activities and periodically thereafter, occupational air samples will again be collected and analyzed for arsenic, lead and TSP. Additional air monitoring will be conducted whenever there is a change in work conditions which can be expected to result in new or additional exposure levels or whenever an employee complains of symptoms which may be attributable to exposure to lead or arsenic.

Qualitative work zone air monitoring may be conducted using real-time instruments which measure the light-scattering effect of particulates.

B.8.0 MEDICAL SURVEILLANCE PROGRAM

A medical surveillance program provides a means of selection of employees who are physically able to safely perform the work assigned and monitor their health on a regular basis. The medical surveillance program to be implemented for this project will comply with 29 CFR 1910.120(f).

The program consists of a pre-employment medical evaluation to determine fitness for the job assignment, an annual evaluation based on length of assignment or attending physicians opinion (no greater than biennially), and an end-of-employment evaluation. In addition, a special evaluation is warranted when an employee indicates symptoms resulting from a possible exposure to hazardous substances.

Medical surveillance will be conducted for all site personnel who may be exposed to arsenic and lead in excess of PELs, without regard to the use of respirators, for 30 days or more per year. All personnel participating in the medical surveillance program will have an entrance examination which equals or exceeds the following:

- Medical and Occupational History;
- Physical Examination;
- Pulmonary Function Test;
- Six Frequency Audiogram;
- Urinalysis, with microscopic morphology and dipstick;
- Complete Blood Count;
- CHEM 20 Chemistry Screen;
- SAM 9 Drug Screen;
- Chest X-Ray (examined by a 'B' reader); and
- Blood lead and total urine arsenic levels (speciation of total arsenic, will be performed if levels are greater than 50 μg/L, for exit examination only).

All contractor personnel with the potential for chemical exposure as outlined above are required to have medical monitoring which equals or exceeds this program. Visitors and regulatory personnel who will enter the work area other than in enclosed vehicles may be required to demonstrate participation in a medical program which is equivalent to or exceeds the standards of this program. The Health and Safety Officer will determine which personnel must meet training and medical-monitoring requirements.

Prior to the start of project activities, all employees with potential for airborne contaminant exposure will have a baseline evaluation conducted for lead levels in blood and urine arsenic levels (speciation, if necessary). These evaluations are to be repeated at the completion of work activities or at the end of employment. If an employee is removed from a project to conduct work at another site off Kennecott property, that employee shall receive an additional bio-metals exam before leaving and upon return to the Kennecott project, regardless of the off-site duration.

Copies of the physician's written opinion for the capability of the individual to work in areas with a potential for arsenic and lead exposure and the ability to wear a respirator will be maintained by the Health and Safety Officer for all workers on site. The completed and signed respirator fit test form will be kept in the same file.

B.9.0 STANDARD OPERATING PROCEDURES/SAFE WORK PRACTICES

Standard operating procedures and safe work practices for this project consist of Kennecott General Safety for Contractors, Kennecott Emergency Protocols, and the following:

- No alcohol, firearms, or illegal drugs will be allowed on Site.
- Any employee under a physician's care and/or taking prescribed medication must notify the Site Health and Safety Officer.
- Eating, drinking, smoking and chewing tobacco or gum are allowed only in designated areas and never in the removal work zone or at the dump site.
- All personnel shall listen for warning signals on construction equipment and shall yield to equipment.
- All equipment operators shall pay careful attention to workers on the ground who may be in their path and provide warning to these people before moving. All employees working regularly on the ground will wear orange vests with reflective tape. Operators shall also pay deliberate attention to all types of utility lines and sources.
- All personnel are required to be familiar with and abide by the security rules, and emergency procedures.
- All personnel must report any injuries, vehicle accidents, and/or illnesses to their supervisor. This includes minor or slight injuries.
- All newly hired employees must pass a pre-work assignment physical and subsequent exams as required by this plan.
- All personnel must participate in the air-quality exposure monitoring program by wearing personal monitors or sampling devices designated by the Site Health and Safety Officer.
- All personnel must abide by all safety rules and procedures as described in the work rules and/or throughout the project.
- Remember, safety starts with you.

B.10.0 NAMES AND NUMBERS OF KEY PERSONNEL

The following persons have been identified to oversee the safety and health of employees involved with Kennecott work activities:

Mr. Paul Riley - Kennecott Plant Projects Group Health and Safety Officer (HSO).

Telephone - 569-7010
Mobile - 580-1497
Pager - 481-3842
Radio - #3-13

Fire/Medical Emergency - 569-6211

Copperton Clinic - 569-6095

Contractor Site Superintendent

Contractor Designated Safety Director

Signature Form

By signing below, I have read and understand the Health and Safety Plan above and the attached referenced documents. I will abide by all safety guidelines established herein.

APPENDIX C

SOIL SAMPLING AND ANALYSIS PLAN

C.1.0 INTRODUCTION

Following removal activities, soil will be sampled and analyzed to document concentrations of the constituent of concern (lead). Discrete (if required) and composite soil samples will be collected and quantitatively analyzed. The sampling program for quantitative analysis is designed to fulfill the data requirements of the consolidation action which include:

- The samples collected are representative of the materials sampled;
- Sample integrity is maintained and documented;
- Proper measurements and information are recorded;
- Sample volumes are sufficient for the required analytical procedures;
- Analytical results adequately characterize soil; and
- The sampling protocol is efficient and relatively uncomplicated.

C.2.0 POST-REMOVAL SAMPLING PROCEDURE

The following sections outline the standard operating procedure (SOP) to be followed in conducting sampling for quantitative analysis. The site-specific Health and Safety Plan shall be complied with at all times during sampling.

C.2.1 Sample Collection

Post-removal soil samples will be collected using disposable plastic or stainless steel hand tools. At each subsite a hole will be dug to at least six inches below surface. A disposable plastic cup will be placed at four inches below surface and a clean sampling tool will be used to scrape sample material from the side of the hole allowing it to fall into the cup. The contents of the cup will be poured into a labeled sample bag. An equal amount of material will be collected from each subsite.

C.2.1.1 Generation of Composite

Post-removal samples collected in areas where elevated levels of the indicator metal were identified will consist of 5-point composite subsite samples which will be homogenized following the protocol described in Section C.3.2. The subsite sample locations will be arranged in a grid consisting of 200′ square composite cells. The 200′ square cell will have subsites located at each of the corners and one located at the center point of the square. Due to the various shapes of removal areas, alterations to the 5-point composite cell will be introduced to ensure adequate coverage of the post-removal areas. Figure 1 depicts an example of a typical composite cell configuration.

Post-removal samples for all areas other than described above will consist of 5-point composite subsite samples which will be homogenized following the protocol described in Section C.3.2. The subsite sample locations will be arranged in a grid consisting of 400' square composite cells. The 400' square cell will have subsites located at each of the corners and one located at the center point of the square. Due to the various shapes of removal areas, alterations to the 5-point composite cell will be introduced to ensure adequate coverage of the post-removal areas. Figure 1 depicts an example of a typical composite cell configuration.

C.2.1.2 Sampling Sequence

The following sequence of events will be followed for all collected soil samples.

1. Fill out logbook header at the beginning of the day;
2. Document initial information about the individual samples and conditions in a field logbook, including a map or diagram;
3. Label container with sample number, date, time, any comments, and samplers' initials;
4. Collect the sample. As a precautionary measure always collect twice the required sample volume;
5. Place soil samples in separate sample containers;
6. Record sample description in the field logbook; and
7. Ensure required duplicates, splits and other QA/QC samples are included (10%, i.e. every tenth sample).

Figure 1.0

At days end:

8. Prepare chain-of-custody forms for all samples;

9. Package and deliver or ship samples, including chain of custodies.

Each sequence event is described in detail in the following sections.

C.2.1.3 Logbook Header

An up-to-date sampling field notebook will be maintained by on-site personnel during all sampling activities. The general information recorded for each days' sampling event includes:

- Date;
- Name of overall sampling event;
- Sampling personnel; and
- Climatic conditions.

C.2.1.4 Logbook Sample Entries

QA/QC procedures for soil sampling require completion of a field sampling log. The sampling log is an extremely important piece of documentation and should be completed with great attention to detail. For each sample collected, the logbook must contain:

- sample number;
- location with measurements if necessary;
- time;
- sampling method;
- field observations; and
- a map or diagram.

Significant deviations from sampling protocol should be formally noted in the field log, along with visiting personnel and unusual circumstances which might affect the sampling.

C.2.1.5 Container Label

To prevent misidentification of samples, each sample container will be labeled prior to sample collection. Labels will be written with indelible ink and will be sufficiently durable to remain on the container. The following information will be recorded on the sample container:

- Sample identification number;
- Initials of sampling personnel;
- Date and time of collection; and
- Location and other pertinent comments.

C.2.1.6 Decontamination

All samples will be collected with either disposable sampling tools or re-usable stainless steel sampling tools. In the event re-usable sampling tools are needed, the equipment will be decontaminated in clean areas that are remote from potential contaminant sources. The decontamination procedures are as follows:

1. Remove gross contaminants;

2. Wash with Alconox or other lab soap;

3. Rinse with tap water;

4. Triple-rinse with deionized water;

5. Repeat all or part of the procedure, if necessary; and

6. Place sampling tools in individual sealed bags.

Field personnel conducting the equipment decontamination and sampling will be required to wear protective gloves and the personal protective wear required under the HASP. The decontamination procedures used will be recorded in the field logbook.

C.2.2 Chain-of-Custody

Chain-of-custody forms should be available in the field. If for any reason, the sampling foreman must leave, he should sign off of the chain-of-custody form and his assistant or replacement should sign on and assume responsibility for sample custody.

To establish the documentation necessary to trace sample possession from the time of collection, a chain-of-custody record will be filled out and accompany every set of samples. The record will include the following:

- List of sample numbers;
- Signature of collector;
- Date and time of collection;
- Sample types;

- Number of containers;
- Parameters requested for analysis for each sample;
- Signature of person(s) involved in the chain of possession; and
- Inclusive dates of possession.

C.2.3 Sample Packaging and Shipping

Sample preparation and packaging will be conducted in clean areas that are remote from potential contaminant sources. The soil sample containers will be cleaned and secured in shipping containers. Packing material will be provided to stabilize the shipping containers if necessary.

Samples will be delivered to the laboratory daily or when an appropriate number of samples have been collected. In cases where samples will leave the immediate control of project personnel, a seal will be affixed to the sample container to ensure that the samples have not been disturbed during storage or transportation. The integrity of the seal will be observed and documented upon arrival at the laboratory.

C.3.0 QUALITY ASSURANCE PROJECT PLAN OBJECTIVES

The purpose of data quality assessment is to assure that data generated under the QA program are accurate and consistent with the consolidation action Objectives stated in Section 2.1 of the Work Plan. The quality of the data will be assessed based on precision, accuracy, completeness, representativeness, and compatibility.

Precision:	$\pm$20 %RPD, $\pm$20 % RSD (field duplicates; lab duplicates; check standards);
Accuracy:	Blanks, matrix spikes, post-digestion spikes;
Representativeness:	Ensure that samples are representative for area; appropriate and accepted analytical procedures are used; problems in investigation are properly documented;
Completeness:	Ensure all samples defined in plan are analyzed. The goal for completeness is 90%; and
Comparability:	Use standard EPA analytical methods.

The project data objectives for precision, accuracy, completeness, representativeness, and compatibility are consistent with guidelines established by the EPA Contract Lab Program.

C.3.1 QA/QC Samples

Internal QA/QC comparisons will be conducted to ensure accurate and reproducible results are ascertained from the laboratory. Kennecott will provide splits of field samples for analysis by the USEPA or UDEQ upon request.

One decontamination rinsate sample will be collected for ten percent of all soil samples collected if non-disposable sampling implements are used. Factory or laboratory sealed disposable sampling implements will be used once and discarded, therefore no decontamination rinsate samples will be collected from disposable sampling equipment.

C.3.2 Analytical Methods

Post-removal soil samples will be analyzed for the constituents of concern according to EPA Methods. Post-removal samples will be analyzed for lead to ensure the target clean up level of 2000 ppm has been achieved. The post-removal samples will be analyzed to document soil concentrations of sulfate at the completion of project activities. The samples and splits will be analyzed at a Certified Environmental Laboratory (Ford Analytical Laboratories) in Salt Lake City, Utah. All analytical procedures will be consistent with federal guidance (US EPA 1986).

To assure precision, accuracy, and completeness, the following steps will be conducted by laboratory personnel and observed by KUC/PPG personnel:

a) The raw sample will be delivered to the lab and homogenized by stirring. Following ASTM cone-split procedure, one-third of the sample will be archived ("as is"). The remaining two-thirds will be air dried. After drying, the sample will be screened with a #80 sieve and the +80 fraction discarded. The remaining sample will be placed in a container and stirred to homogenize. The ASTM cone and quarter method will be used to make four laboratory splits of the homogenized -80 fraction by KUC/PPG personnel. The four parts of the sample will be distributed as follows:

    - One part to USEPA;
    - One part to UDEQ;
    - One part to the laboratory for analysis; and

- One part to KUC/PPG. This portion of sample will be returned to the KUC/PPG laboratory and ten percent of the sample split, re-numbered, and re-submitted for analysis at the analytical laboratory. The remaining sample material will be archived by KUC.

Relative percent difference (RPD's) between the results of split samples will be calculated and plotted.

b) The analytical method for lead is 6010 (detection limit 1.0 mg/kg).

c) The laboratory will be requested to provide "NIST/EPA STANDARDS" and samples analyzed for lead as necessary, with the lab reporting the actual results. Analyzed parameters will be compared with the EPA's reported analysis. Upper Control Limits (UCL) and Lower Control Limits (LCL) will be calculated and graphed as per EPA's standard protocol.

d) The lab will also be asked to spike every tenth (10th) sample and report the spike recovery percent. The results will be graphed with the UCL and LCL's.

C.3.3 Data Reduction, Validation, and Reporting

All data will be reported in appropriate units. All raw data will be reviewed and validated against calibration records to ensure that data are reliable, and that data are in compliance with QA/QC objectives. Upon completion, a copy of the signed laboratory report will be submitted to the appropriate agency for review.

Raw data from field measurements and sample collection activities that are used in project reports will be appropriately identified.

QC records showing accumulated precision and accuracy data will be maintained in the laboratory and reported along with analytical results. Poor quality results will be investigated immediately and questionable data will be reanalyzed.

C.3.4 Laboratory Performance Audit

KUC/PPG will audit the Analytical Laboratory randomly to ensure laboratory performance is consistent with data quality and quality assurance objectives stated in the Kennecott QAPP and Work Plan for the Evaporation Ponds Site.

C.3.5 Corrective Action

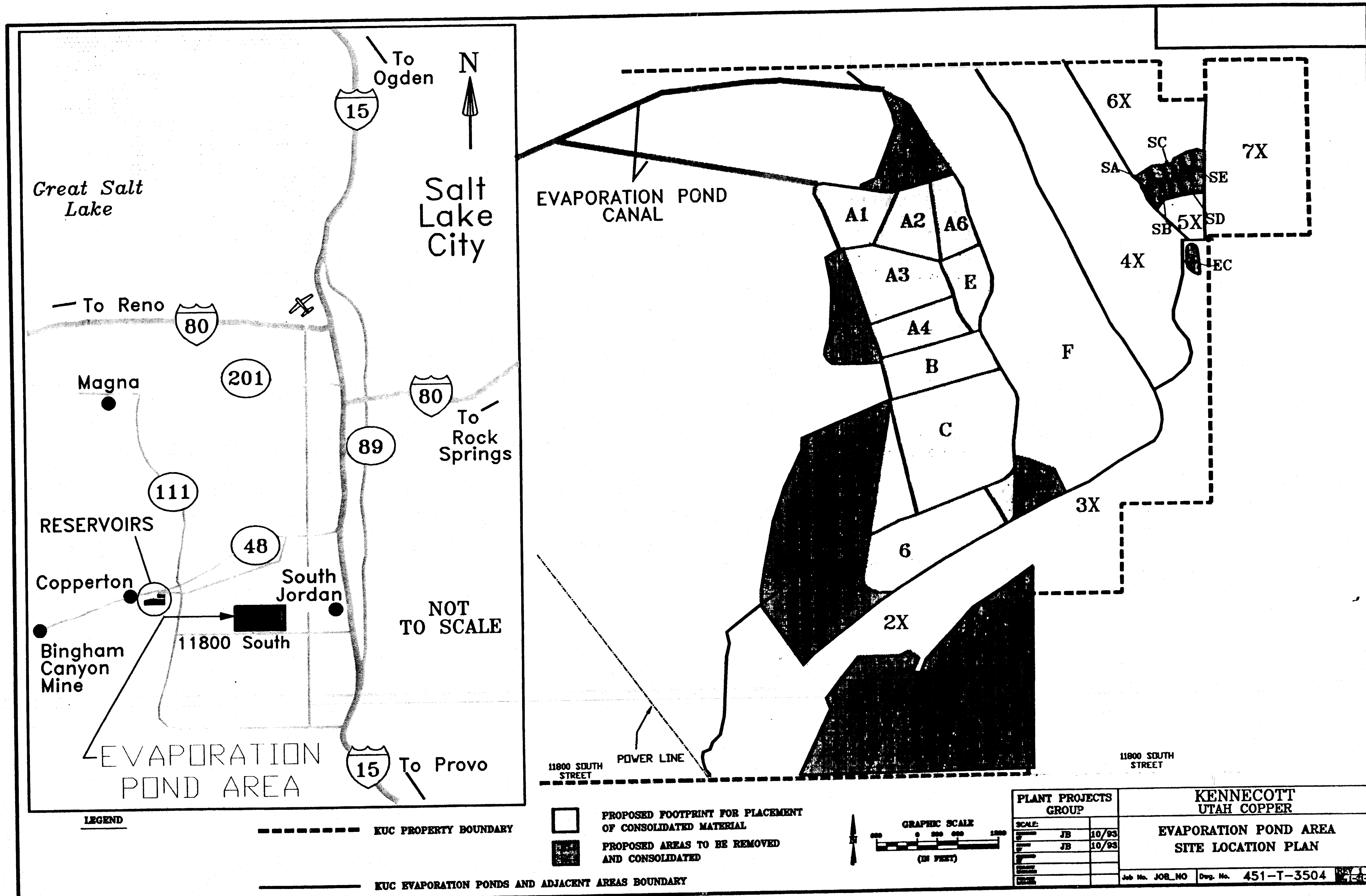
If QC results detect conditions or data that do not meet QC requirements, corrective action will be initiated. The nature of the action will depend on the circumstances unique to each situation and may include:

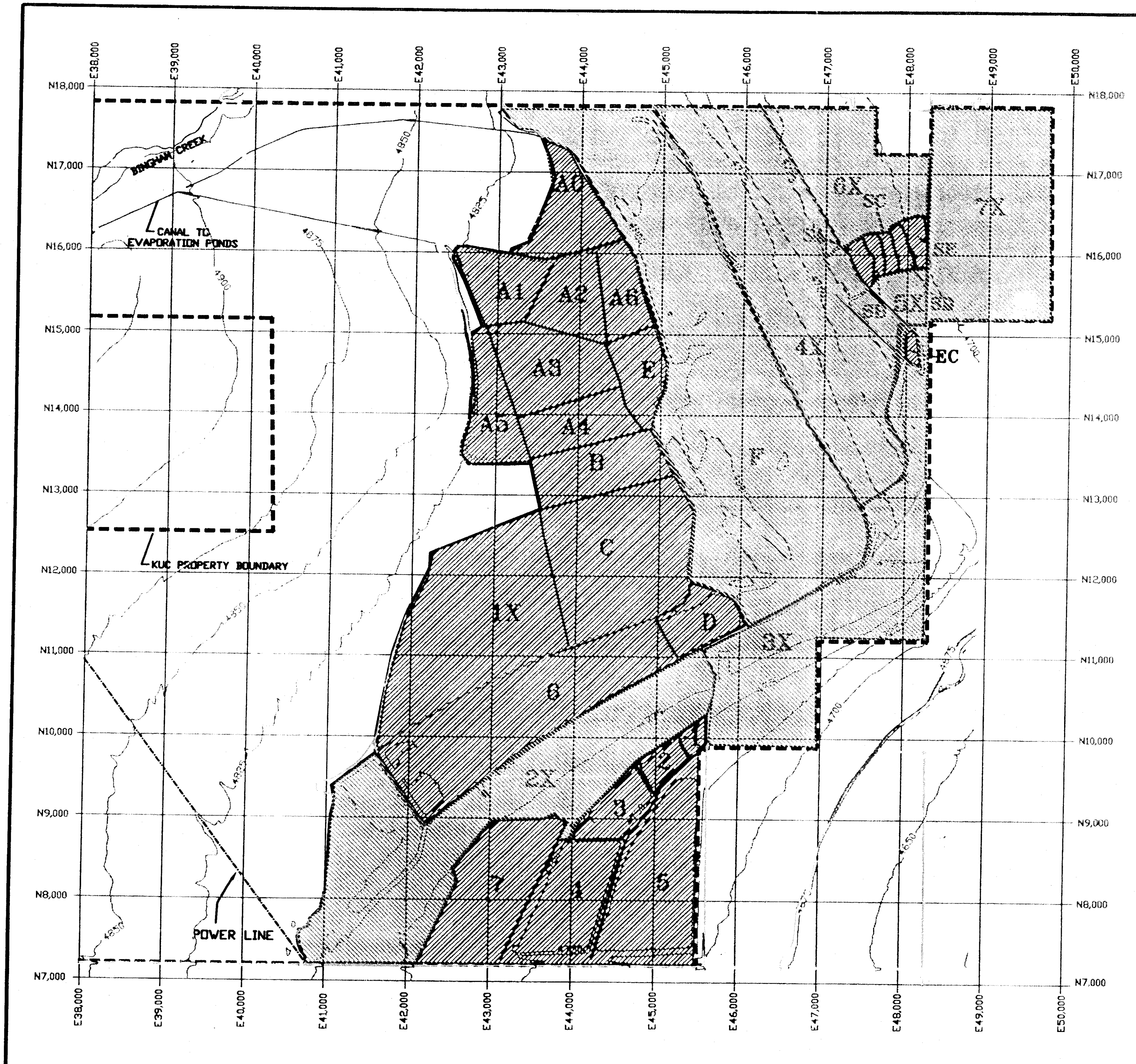
- Accepting data, acknowledging level of uncertainty;
- Reanalyzing the samples, if holding time criteria permit;
- Resampling and analyzing; and
- Evaluating and amending sampling and analytical procedures.

C.3.6 QA Reports to Management

Final field and laboratory reports will be submitted to the QA/QC Officer for review; issues requiring clarification will then be addressed. Following review by the QA/QC Officer, final field and laboratory reports and a final report will be submitted to the KUC Project Manager.

Significant finds will be highlighted in the progress reports to USEPA and UDEQ. A detailed summary will accompany the Final Report.


Great Salt Lake
To Ogden
15
N
Salt Lake City
To Reno
80
Magna
201
80
To Rock Springs
89
111
RESERVOIRS
48
Copperton
South Jordan
Bingham Canyon Mine
11800 South
NOT TO SCALE
EVAPORATION POND AREA
15
To Provo
EVAPORATION POND CANAL
A1
A2
A6
A3
E
A4
B
C
F
6
2X
3X
4X
5X
6X
7X
SA
SB
SC
SD
SE
EC
POWER LINE
11800 SOUTH STREET
11800 SOUTH STREET
LEGEND
KUC PROPERTY BOUNDARY
KUC EVAPORATION PONDS AND ADJACENT AREAS BOUNDARY
PROPOSED FOOTPRINT FOR PLACEMENT OF CONSOLIDATED MATERIAL
PROPOSED AREAS TO BE REMOVED AND CONSOLIDATED
GRAPHIC SCALE
(IN FEET)
PLANT PROJECTS GROUP
JB 10/93
JB 10/93
KENNECOTT UTAH COPPER
EVAPORATION POND AREA SITE LOCATION PLAN
Job No. JOB_NO
Dwg. No. 451-T-3504



APPROXIMATE ACREAGE OF SOUTH JORDAN EVAPORATION PONDS AND ADJACENT AREAS

POND	ACRES	POND	ACRES
A-0	20.0	1	2.0
A-1	17.3	2	4.5
A-2	16.9	3	10.9
A-3	28.1	4	38.4
A-4	15.2	5	46.6
A-5	14.9	6	70.6
A-6	12.1	7	38.2
B	20.4	SA	2.2
C	62.3	SB	1.4
D	14.8	SC	1.4
E	13.1	SD	1.7
1X	79.5	SE	2.9
EC	1.1		

AREA	ACRES	AREA	ACRES
F	121.8	5X	6.9
2X	131.6	6X	44.6
3X	76.9	7X	79.0
4X	158.7		

EVAPORATION POND

ADJACENT AREA

KUC PROPERTY BOUNDARY

KUC EVAPORATION PONDS BOUNDARY

GRAPHIC SCALE (IN FEET)

NOTE

CONTOUR INTERVAL = 25'

TOPOGRAPHY DERIVED FROM 1990 PHOTOGRAPHY

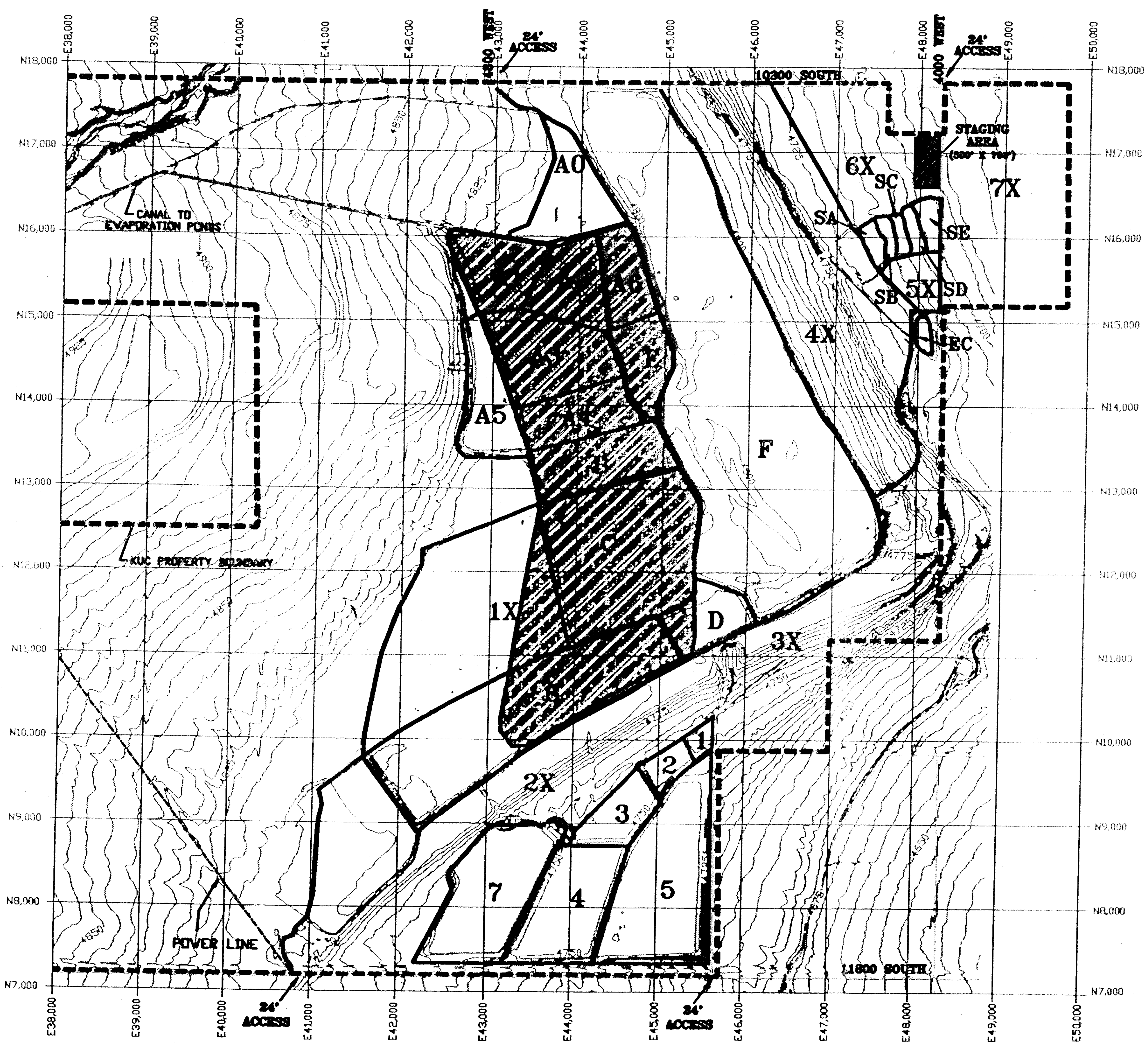
PLANT PROJECTS GROUP

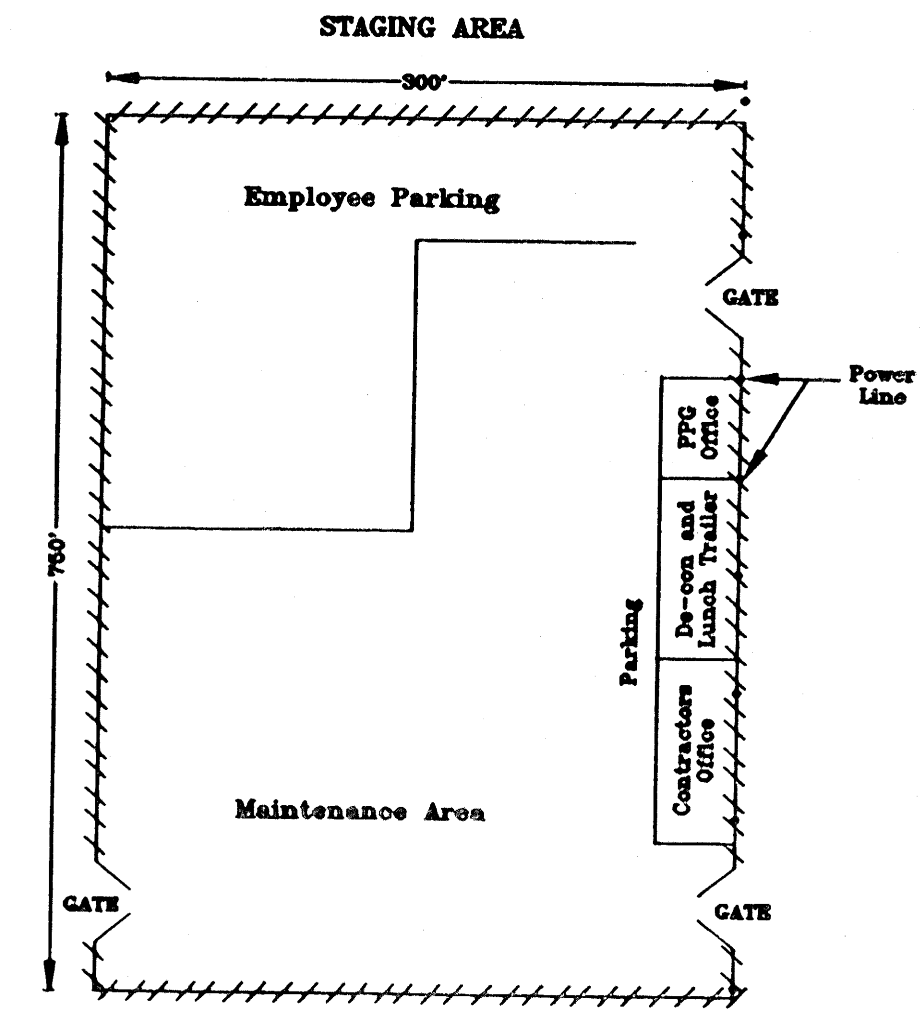
KENNECOTT UTAH COPPER

SOUTH JORDAN EVAPORATION PONDS ACREAGE MAP

SCALE: JB 11/93 JB 11/93

Job No. JOB_NO Dwg. No. 451-T-3505 REV 0





CHAIN LINK FENCE

PROPOSED FOOTPRINT FOR PLACEMENT OF CONSOLIDATED MATERIAL

KUC PROPERTY BOUNDARY

KUC EVAPORATION PONDS BOUNDARY

*All access gates will provide entry for all heavy equipment and semi-trailor trucks.

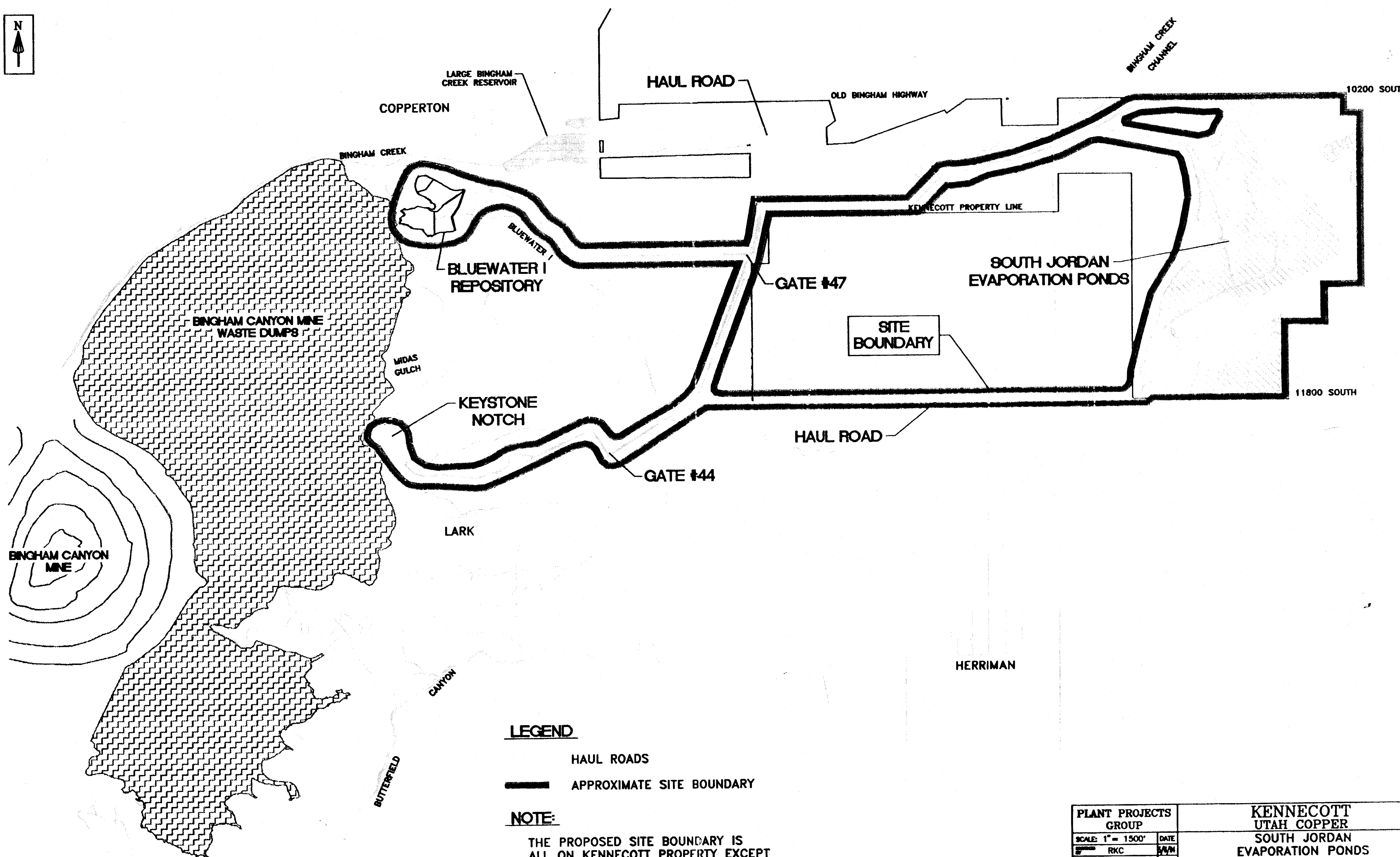
GRAPHIC SCALE

NOTE

CONTOUR INTERVAL = 25'

TOPOGRAPHY DERIVED FROM 1990 PHOTOGRAPHY

PLANT PROJECTS GROUP	KENNECOTT UTAH COPPER
SCALE 1"=600'	SOUTH JORDAN EVAPORATION PONDS SITE LAY-OUT, CONTRACTOR STAGING, OFFICE, PARKING AND SITE ACCESS
DJ 2/94	
JB 2/94	
Job No. JOB_NO	Dwg. No. 451-T-3516



LEGEND

HAUL ROADS

APPROXIMATE SITE BOUNDARY

NOTE:

THE PROPOSED SITE BOUNDARY IS ALL ON KENNECOTT PROPERTY EXCEPT THE PROPOSED HAUL TRAFFIC ALONG 11800 SOUTH.

PLANT PROJECTS GROUP		KENNECOTT UTAH COPPER
SCALE: 1" = 1500'	DATE	SOUTH JORDAN EVAPORATION PONDS WORK ACTION SITE BOUNDARY
RKC	5/6/94	
RKC	5/6/94	
		Job No. ----
		Dwg. No. 451-T-3522
		REV 0